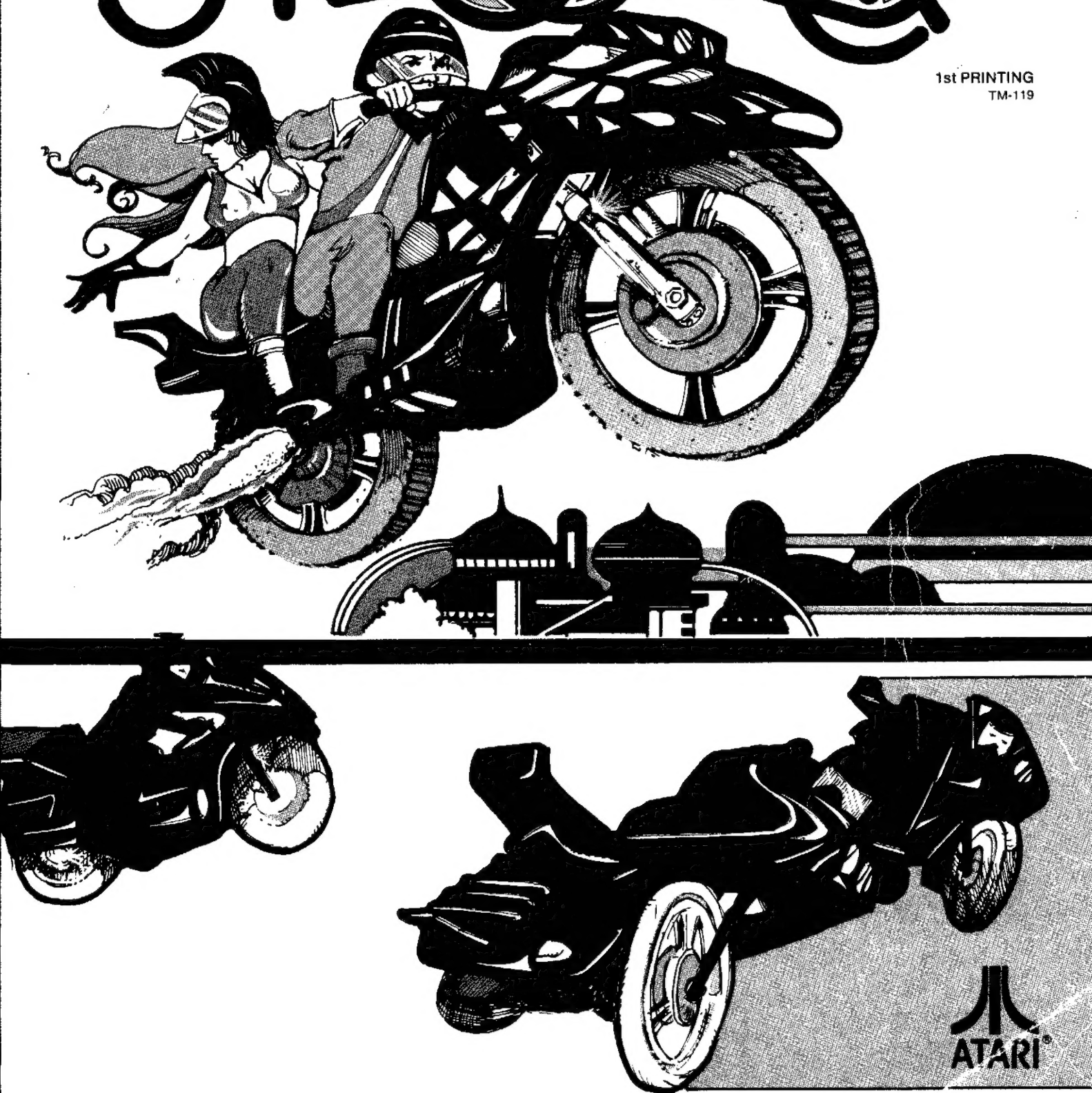
SPACE RIDER™

1st PRINTING
TM-119

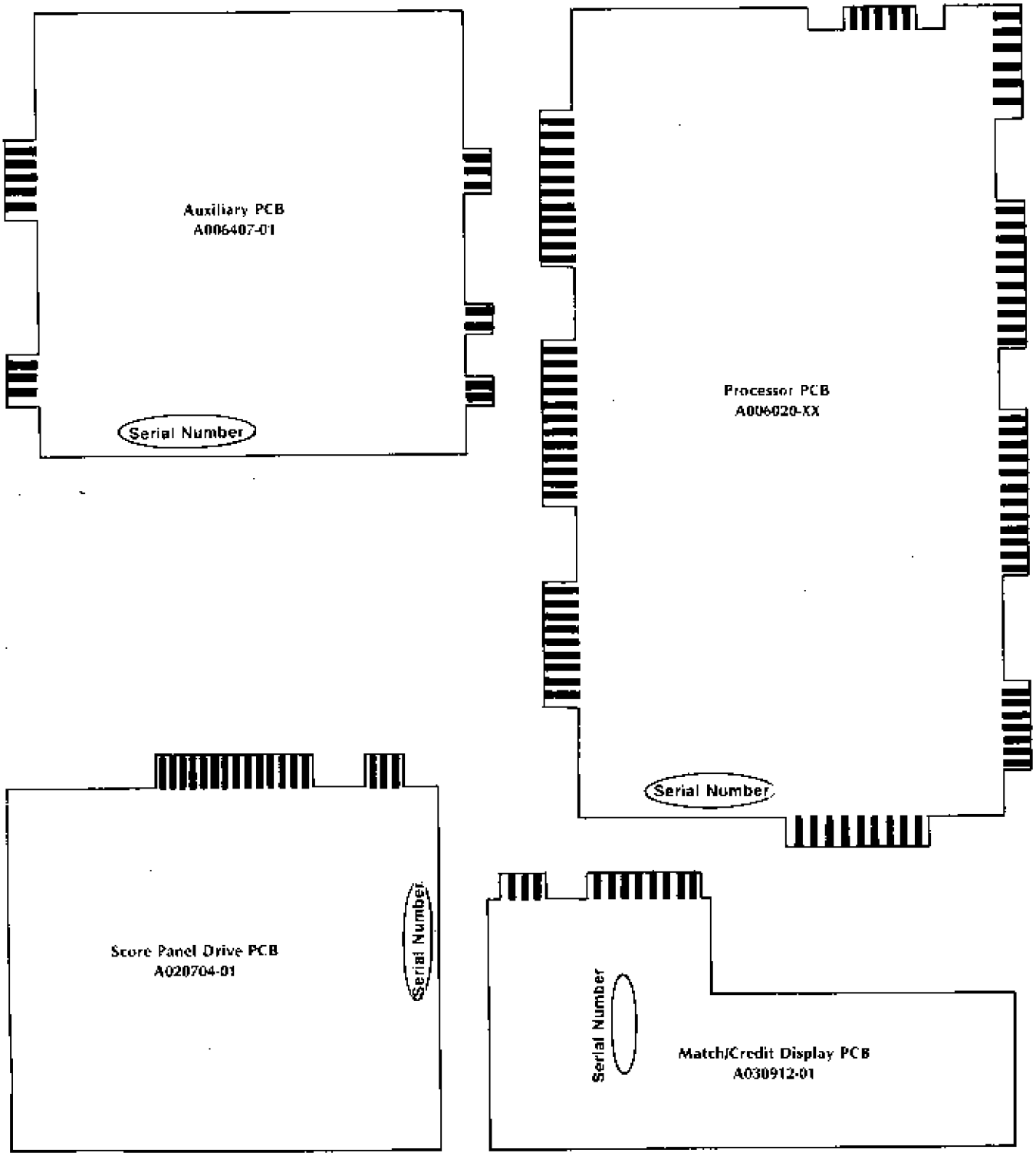


ATARI®

Operation, Maintenance and Service Manual
Complete with Illustrated Parts Catalog

Location of Serial Numbers

Your game's serial number is stamped on all four printed circuit boards, in the locations shown below. The same number is also stamped on the label located on the rear of the back box. Please mention this number whenever calling your distributor for service.

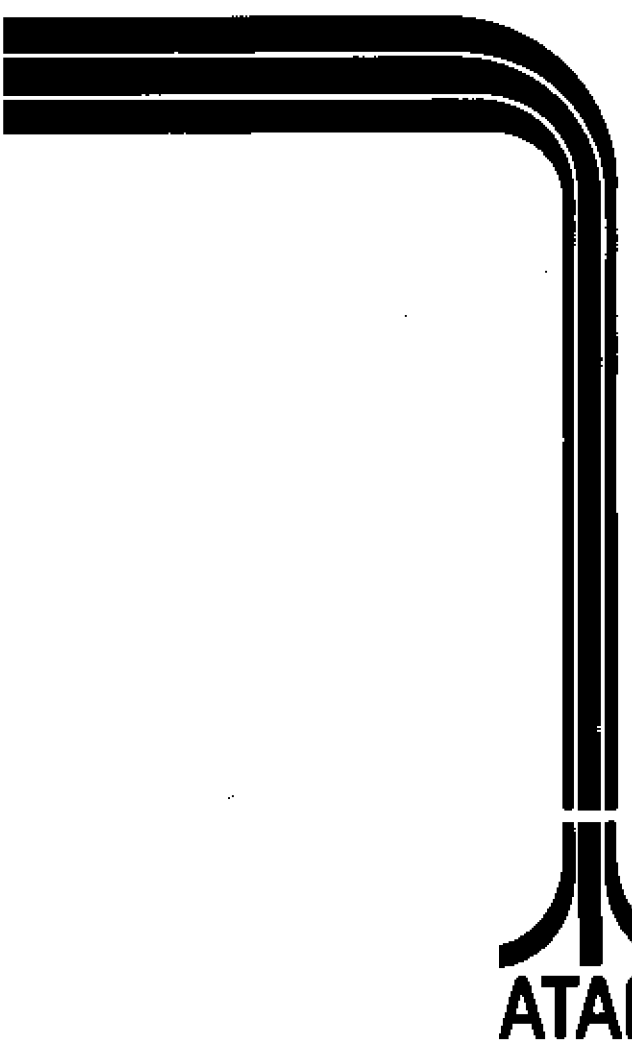


Space Riders™

Operation, Maintenance and Service Manual

Complete with Illustrated Parts Catalog

ATARI INC
1265 BORREGAS AVENUE
P.O. BOX 9027
SUNNYVALE, CALIFORNIA 94086
408/745-2000 • TELEX 35-7488



ATARI®

A Warner Communications Company

For permissions requests, write:

ATARI INC
1265 Borregas Avenue
P.O.Box 9027
Sunnyvale, California 94086

9G
Lithographed in the U.S.A.

TABLE OF CONTENTS

TABLE OF CONTENTS

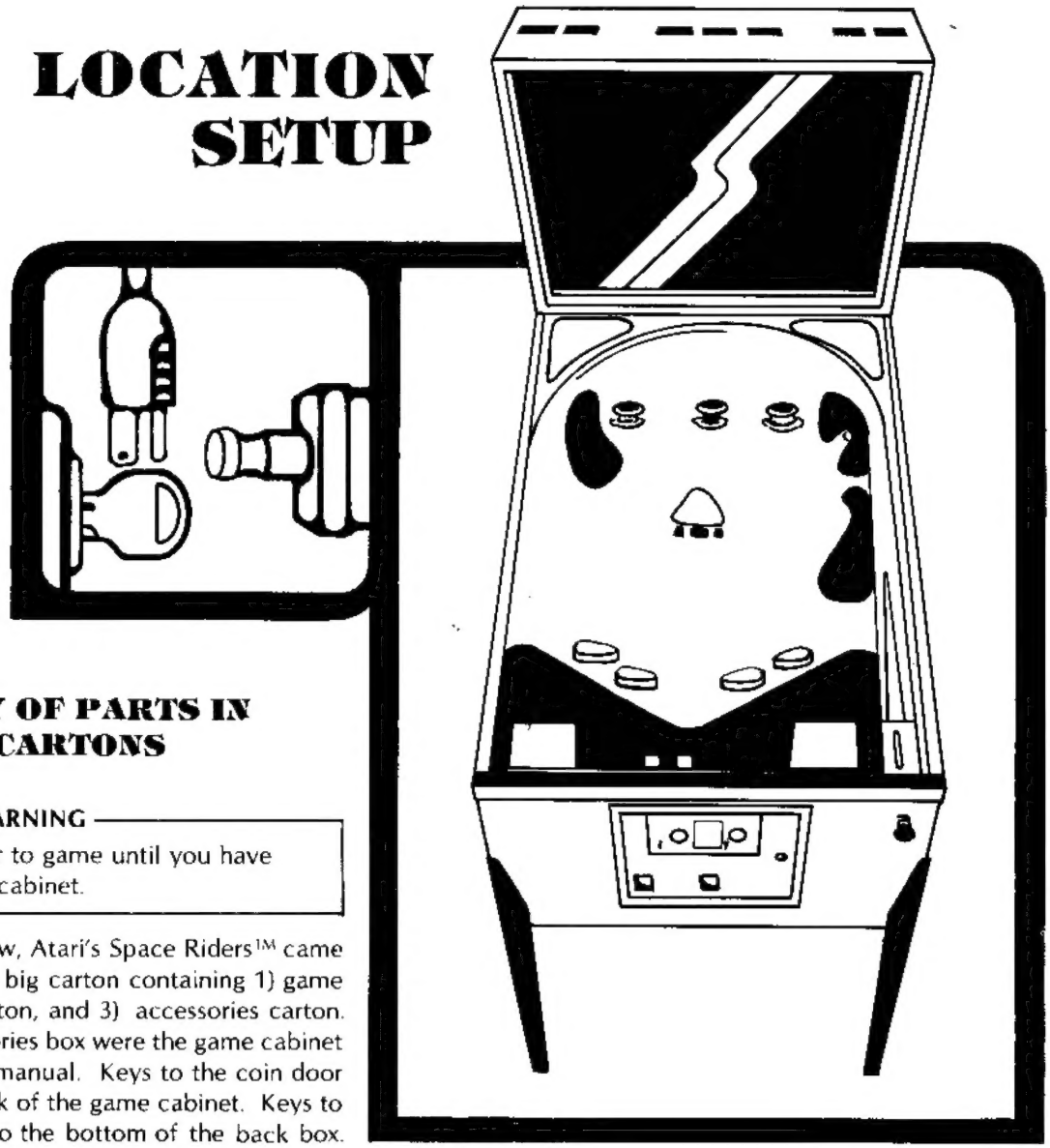
TABLE OF CONTENTS

7 ILLUSTRATED PARTS CATALOG

LIST OF ILLUSTRATIONS

LIST OF TABLES

LOCATION SETUP



A. INVENTORY OF PARTS IN SHIPPING CARTONS

WARNING

Do not apply power to game until you have inspected inside of cabinet.

As you already know, Atari's Space Riders™ came to you packaged in one big carton containing 1) game cabinet 2) back box carton, and 3) accessories carton. Contained in the accessories box were the game cabinet legs, cash box, and this manual. Keys to the coin door are taped to the top back of the game cabinet. Keys to the back box are taped to the bottom of the back box.

B. ASSEMBLY OF GAME

1. Assembly of Legs and Back Box

First, screw leg levelers (from cash box) into the bottom of each leg. Screw the leg leveler locking nuts onto the leg levelers.

If you have a Pin Jack—Place cabinet onto pin jack and raise cabinet at least 2 feet from floor. Then attach all four legs with eight acorn-head bolts.

If you don't have a Pin Jack—Refer to Figure 1-1 and follow the instructions.

2. Attach Back Box

CAUTION

Back Box carton is labeled "This side up ↑." Set the Back Box carton as labeled before removing the Back Box from the carton. This will prevent the Back Box glass from falling out and breaking.

Remove the Back Box and Back Box Key Envelope from the Back Box carton and attach the Back Box to the pin cabinet as instructed in Figure 1-2.

3. Final Inspection

Refer to Figure 1-3 and follow the instructions.

4. Final Assembly

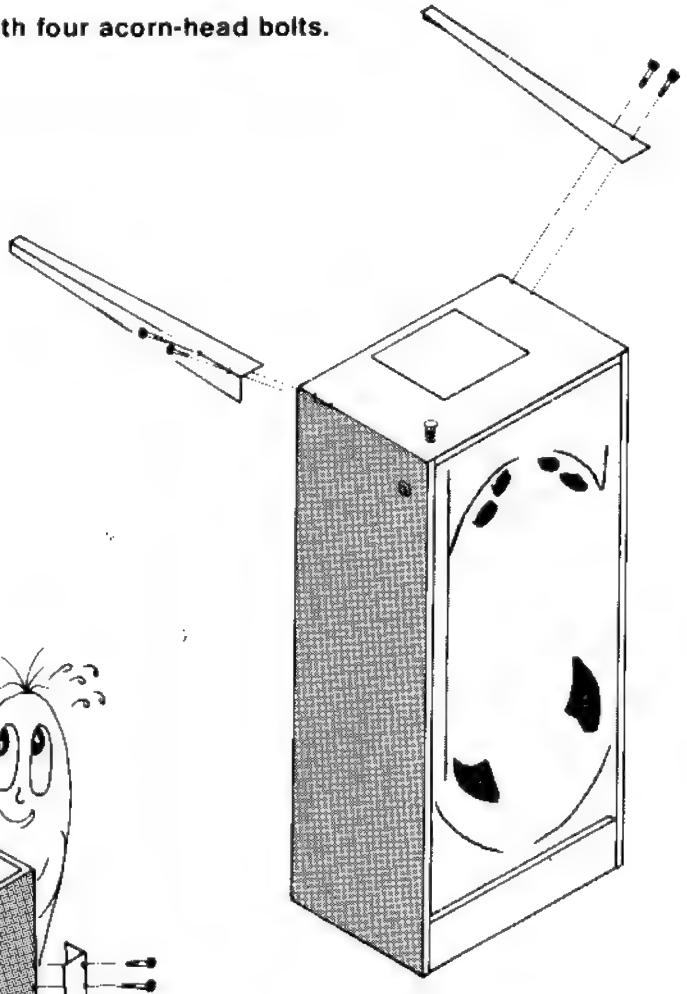
NOTE

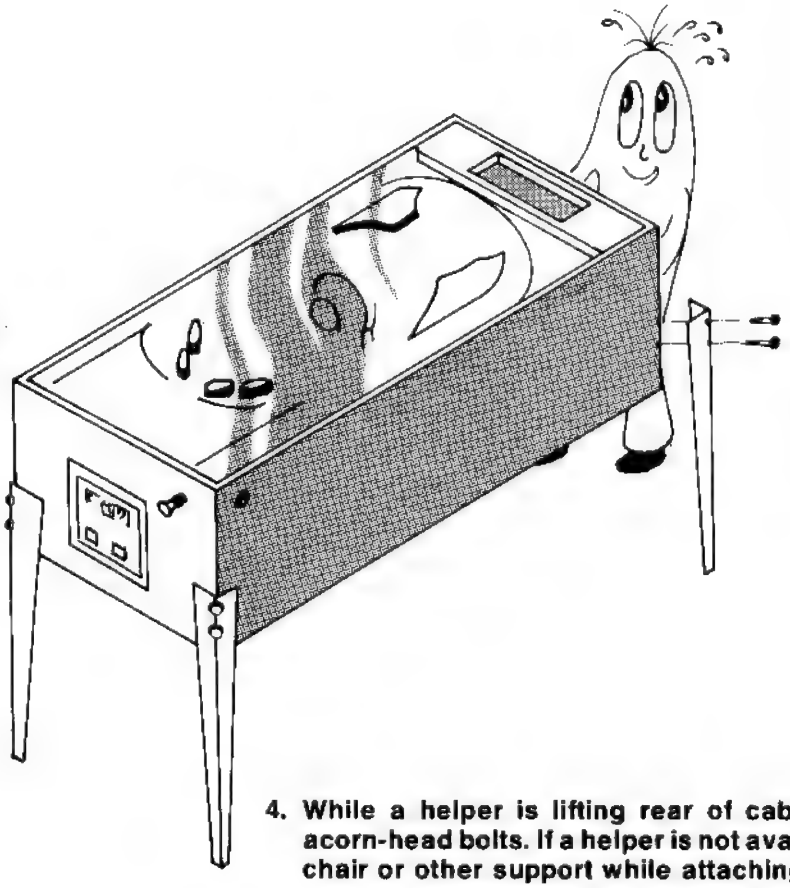
The tilt bob is made of a soft material, carbon: don't overtighten.

1. Install the tilt bob (from cash box) onto the pendulum wire at the right front side of the pin cabinet. Tighten the thumb screw lightly and leave it pointing toward the coin door. This way it will be accessible from the coin door for fine tuning after the playfield is lowered.
2. Place the game ball (from cash box) onto the playfield.
3. Choose the proper instruction cards (from cash box) and attach to the lower arch panel butyrate as illustrated in Figure 1-4.
4. Install the cash box.
5. Lower the playfield and install the playfield glass (for help, refer to Figure 1-3).
6. Level the playfield for a 3° slope from the rear to the front of the playfield.
7. Insert the power plug into a 115 VAC power source.

1. Tilt cabinet and set it on its back on a padded surface (shipping carton works great).

2. Attach two legs to the front of cabinet with four acorn-head bolts.

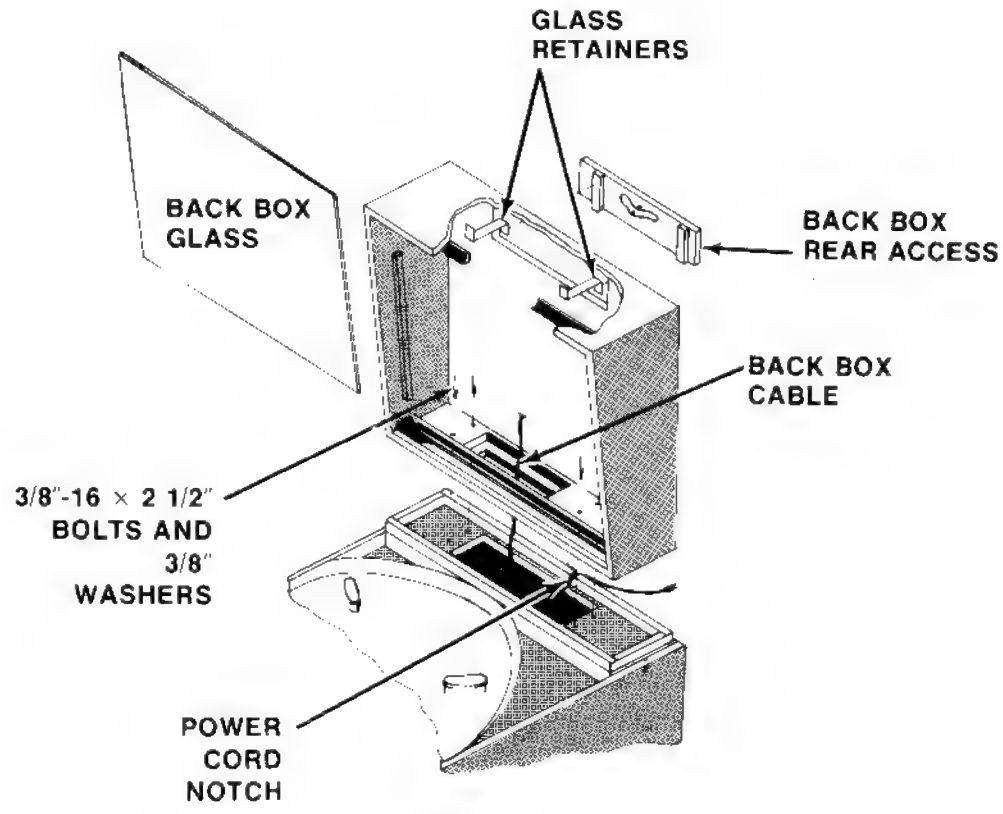




3. Set cabinet down so that it rests on two legs at front edge and cabinet rear bottom.

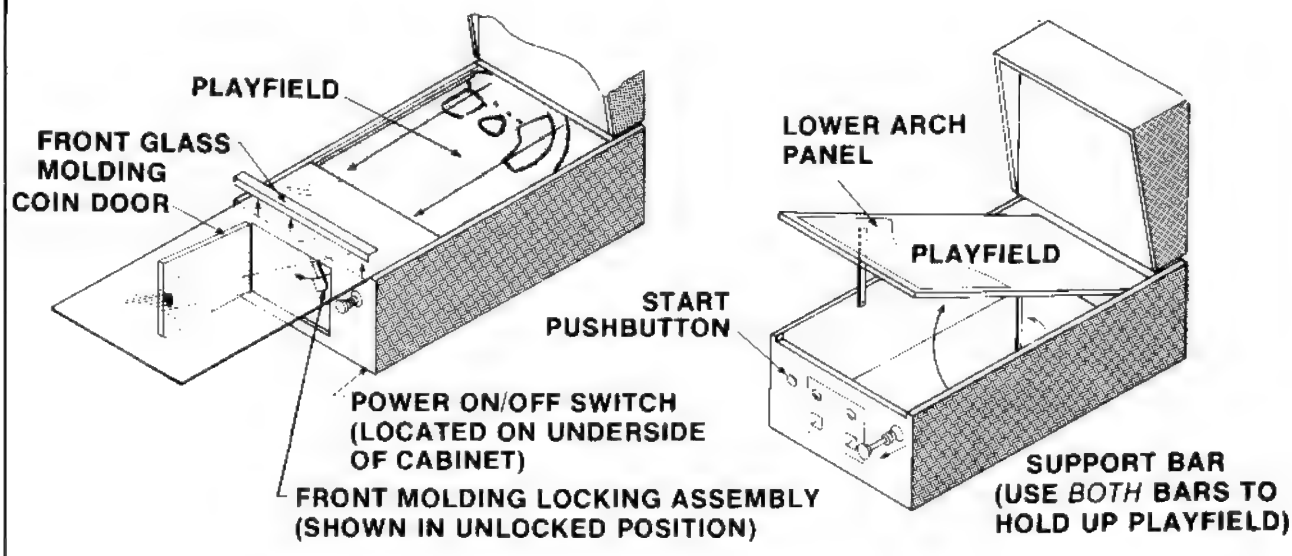
4. While a helper is lifting rear of cabinet, attach two rear legs with four acorn-head bolts. If a helper is not available, rest the rear of the cabinet on a chair or other support while attaching the rear legs.

Figure 1-1 Attaching Legs without Pin Jack



1. Reach into hole at the back of the cabinet and pull out the power cord. Insert the cord into the notch at the back of the cabinet.
2. Remove the key envelope from the top rear of the cabinet.
3. Unlock and remove Back Box rear access.
4. Pull (about 1/2 inch) on both glass retainers.
5. Push up on glass and lift up and out of Back Box.
6. Attach Back Box to the cabinet with four 3/8"-16 × 2-1/2" bolts and four 3/8" flat washers. (Place power cord into the power cord notch.)
7. Unwind Back Box cable and feed down through hole in Back Box and into the cabinet. Plug the cable connector into the two pin connector receptacle on the lower left front of the Power Supply.
8. Snug all lamps, then reinstall Back Box glass.
9. Install and lock Back Box rear access.

Figure 1-2 Attaching Back Box



1. Unlock and open the coin door.
2. Move the playfield Front Molding Locking Assembly to the left and remove the playfield Front Glass Molding,then remove glass.
3. Remove mounting screws from the lower Arch Panel. Pull out and discard the foam packing from above the Score Display. Check that the edge pins of the Score Display are aligned with the pins of the interfacing connector. Remount the Lower Arch Panel.
4. Lift the front of the playfield and rest it on *both* support bars.
5. Locate two loosely tied large nylon cable ties, one mounted on each side of the cabinet, that secure the connectors during shipping. Cut these cable ties.
6. Loosen J21
7. Temporarily lift the black plastic cover from above the Processor PCB by cutting tie-rap from the plastic clips that stick through the black cover.
8. Throughly inspect the game as follows:

Cabinet Inspection

1. Check that all connectors are properly seated.
2. Check thal all fuses are properly seated.
3. Check that there are no disconnected wires.
4. Check entire cabinet for loose or foreign objects that may cause short circuiting.
5. Check that the contacts of the vertical slam switch, located on the bottom of the cabinet, and the coin door slam switch contacts are both open.
6. Check to ensure that the black plastic cover over the Processor PCB is attached.

Playfield Inspection

Check that all harness wires on the underside of the playfield are out of the way of all moving parts and free from being pinched when the playfield is lowered.

Figure 1-3 Final Assembly and Inspection

C. DESCRIPTIONS OF GAME OPTIONS

Several options are available for structuring Space Riders™ for maximum returns at your location. The following is a list of these options:

1. Sixteen coin/credit settings
2. Four maximum credit levels
3. Three- or five-ball game
4. Active or inactive match feature
5. Replay, add-a-ball, or neither for obtaining replay level
6. One or two replay or add-a-ball levels
7. Extra ball or 25,000 points for completing extra ball sequence
8. Liberal or conservative "special" feature
9. Four different awards for "special" (50,000 points, 100,000 points, replay, or extra ball)

D. SETTING THE OPTIONS

WARNING

Power should never be on while setting the options. Dangerous voltages are present inside the game cabinet.

All the options are selectable by merely flipping a switch. Refer to Self-Test Procedure in Table 1-1. Table 1-1 also lists all the options and the switches necessary to set those options. In these tables, all manufacturer suggested settings are marked with dollar signs. Figure 1-4 shows the location of each switch on the Processor PCB (printed circuit board). To set the switches, slightly press down on the selected switch toggles with a small pointed object. To set the toggle to *on*, press on the switch side toward the closest end of the Processor PCB.

With your new game, you received sixteen REPLAY level display cards and sixteen ADD-A-BALL display cards. These cards are printed on both sides. One side is for a 3 BALL game and the reverse side is for a 5 BALL game. Half of the cards (sixteen) are for REPLAY and the other half are for ADD-A-BALL feature. Fifteen of each are printed with the REPLAY or ADD-A-BALL levels that match the resultant levels of the REPLAY rotary switch. The extra two cards are with blank REPLAY and ADD-A-BALL levels. These have been provided in case you should lose a card with the levels at which you would like to set the game.

Once you have set the REPLAY or ADD-A-BALL level(s), insert the display card on the left hand side of the lower arch panel. Make sure the card displays the proper number of balls per game. If you have eliminated the second REPLAY or ADD-A-BALL level, fold the display card so the second level is hidden.

E. SELF-TEST

Self-Test is activated by pressing the TEST push-button. The Test pushbutton is located at the inside top middle of the coin door. Pressing the pushbutton once begins the lamp test; pressing the pushbutton twice begins the solenoid test; and the third time, the switch test. Pressing the pushbutton the fourth time causes the game to exit the Self-Test mode and enter the attract mode of operation.

Now perform the Self-Test Procedure described in Table 1-1. As an aid for locating the playfield switches and solenoids, see Figure 1-5.

F. VOLUME ADJUSTMENT

The volume control for all game sounds is located inside the cabinet above and to the right of the game speaker. To adjust the volume, turn the volume control clockwise to increase the volume and counter-clockwise to decrease the volume.

A second volume control is located inside the cabinet on the Auxiliary PCB (labeled VOL). This volume control should only be adjusted by a qualified technician. Technicians may learn the proper adjustment of this control by reading the instructions in the maintenance chapter (Chapter 3) of this manual.

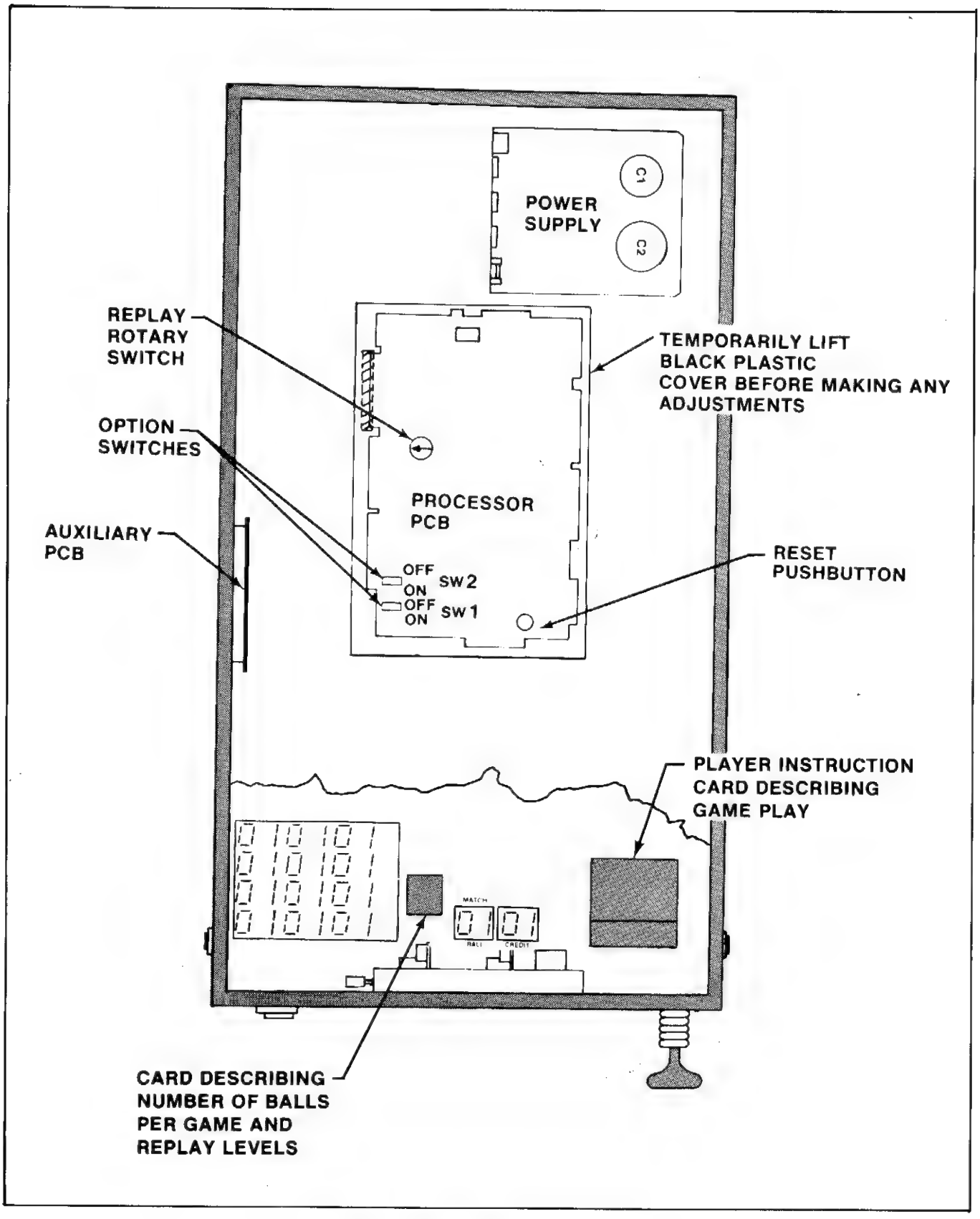


Figure 1-4 Location of Option Switches

Table 1-1 Self-Test Procedure

NOTES:

- *PROG SW1, toggle 1, must always be in OFF position.*
- *Game will enter Self-Test from any mode. However, when Self-Test is entered, all credits (if any) are permanently erased from the credit accumulator.*
- *All manufacturer's suggested option switch settings are identified with a $ symbol in the switch setting Tables. These switch settings are as Atari ships the game.*
- *Volume adjustment may be done either in Switch Test or actual game play.*

TEST NAME	TEST INSTRUCTIONS	INDICATION OF TEST MODE	TEST RESULTS	OPERATOR ACTION
Display Check	Set power switch (located on the right front bottom of the cabinet) to OFF, then back to ON.	The attract mode is the indicator of this test.	Score, BALL, and CREDIT displays are filled with 8s. Score display 1ST UP thru 4TH UP strobes continuously.	Check to ensure that all displays are filled with 8s and score display 1ST UP thru 4TH UP strobes.
Lamp, Replay Levels, and ROM Test	Press and release (once only) TEST pushbutton located on inside top middle of coin door.	(Test number) 1 appears in 4th UP score display.	All lamps are lighted (ignore back box lamps). The FIRST REPLAY/ADD-A-BALL score is displayed in 1ST UP score display. If total elimination of REPLAY ADD-A-BALL is selected, 1ST UP and 2ND UP score display is blank. If SECOND REPLAY/ADD-A-BALL is selected, SECOND REPLAY/ADD-A-BALL score is displayed in 2ND UP score display. If elimination of SECOND REPLAY/ADD-A-BALL is selected, 2ND UP score is blank. Number of balls per game is displayed in BALL display. Maximum credits is displayed in CREDIT display. If the computer memory fails, a 1 and / or 2 appears in the lower left corner of the score display. If memory is OK, the lower left corner of the score display is blank.	Check to ensure that all playfield lamps are lighted. To change REPLAY/ADD-A-BALL values, adjust REPLAY rotary switch and PROG SW1, toggle 8, for the results as listed in the REPLAY/ADD-A-BALL SCORE SETTINGS box. Please note that setting the PROG SW1, toggle 8, to ON results in "REPLAY". Toggle 8 in OFF position results in "ADD-A-BALL". To eliminate SECOND REPLAY/ADD-A-BALL score, set PROG SW1, toggle 3, to OFF. To add SECOND REPLAY/ADD-A-BALL score, set PROG SW1, toggle 3, to ON. To change, set PROG SW2, toggle 1, to OFF for 3-ball game; ON for 5-ball game. To change, set PROG SW1, toggles 5 and 6, as listed in MAXIMUM CREDITS box. A *1* in the lower left corner of the score display indicates a failure of read-only memory location E00. A 2 indicates the failure of read-only memory location E0. NOTE: To exit Self-Test, press and release TEST pushbutton three times, or set power switch to OFF, then back to ON.
Solenoid Test	1. Press and release (once only) TEST pushbutton. 2. To activate next solenoid, press START.	(Test number) 2 appears in 4th UP score display.	Left thumper bumper activates about once a second while the thumper bumper identification number is displayed in the CREDIT display. By pressing START, each solenoid is activated one at a time, until START is pressed again. (By holding START in pressed position, each solenoid energizes twice before advancing to the next solenoid.) Identification number for each solenoid is displayed in the CREDIT display, as listed in OPERATOR ACTION column.	NUMBER IN CREDIT DISPLAY — SOLENOIDS 1 Left Thumper Bumper 2 Right Thumper Bumper 3 Left Slingshot 4 Right Slingshot 5 Outhole Kicker 6 Left Drop Target 7 Center Drop Target 8 Right Drop Target 9 Left Hole Kicker 10 Right Hole Kicker 11 Lockout Coil 12 Flipper Relay NOTE: To exit Self-Test, press and release TEST pushbutton two times, or set ON/OFF switch to OFF, then back to ON.
Switch Test	Press and release (once only) TEST pushbutton.	(Test number) 3 appears in 4th UP score display.	Any activated or stuck switches are identified by a number in the CREDIT display. A pulsing tone is heard when a switch is activated or stuck closed.	Identify activated or stuck switches as shown in SWITCH IDENTIFICATION figure. NOTE: To exit Self-Test, press and release TEST pushbutton once, or set power switch to OFF, then back to ON.
Volume Adjustment (Part of Switch Test)	Activate coin door slam switch.	Pulsing tone is emitted from game speaker.		Reach through coin door and adjust volume control (mounted on the cabinet rib behind the game speaker) for the desired volume.

MAXIMUM CREDITS PER GAME SETTINGS

5 Credits — Set PROG SW1, toggles 5 and 6 OFF
10 Credits — Set PROG SW1, toggle 5 ON and 6 OFF
15 Credits — Set PROG SW1, toggle 5 OFF and 6 ON
$ 20 Credits — Set PROG SW1, toggle 5 and 6 ON

COINS PER GAME SETTINGS

Left Coin Acceptor	Right Coin Acceptor	PROG SW2 toggles 3	4	5	6
$ 2 coins/3 credits[1]	2 coins/3 credits[1]	OFF	OFF	OFF	OFF
2 coins/5 credits[1]	2 coins/5 credits[1]	ON	OFF	OFF	OFF
2 coins/1 credit[2]	2 coins/1 credit[2]	OFF	ON	OFF	OFF
1 coin/1 credit	1 coin/1 credit	ON	ON	OFF	OFF
1 coin/2 credits	1 coin/2 credits	OFF	OFF	ON	OFF
1 coin/3 credits	1 coin/3 credits	ON	OFF	ON	OFF
1 coin/4 credits	1 coin/4 credits	OFF	ON	ON	OFF
1 coin/5 credits	1 coin/5 credits	ON	ON	ON	OFF
1 coin/5 credits[4]	2 coins/5 credits[1]	OFF	OFF	OFF	ON
1 coin/14 credits[5]	2 coins/5 credits[2]	ON	OFF	OFF	ON
1 coin/12 credits[5]	2 coins/5 credits[1]	OFF	ON	OFF	ON
1 coin/5 credits[6]	1 coin/2 credits[3]	ON	ON	OFF	ON
1 coin/6 credits[5]	2 coins/2 credits[2]	OFF	OFF	ON	ON
1 coin/12 credits[5]	1 coin/2 credits	ON	OFF	ON	ON
1 coin/12 credits[3]	2 coins/4 credits[2]	OFF	ON	ON	ON
3 coins/2 credits[3]	3 coins/2 credits[3]	ON	ON	ON	ON

NOTES:
[1] Second coin results in one more credit than first coin
[2] No credits until all coins are dropped
[3] One credit for second coin; one credit for third coin
[4] Coin counter advances 2 times for each coin
[5] Coin counter advances 5 times for each coin
[6] Coin counter advances 10 times for each coin

REPLAY OR ADD-A-BALL SETTINGS

$ Replay — Set PROG SW1, toggle 8, to ON, then adjust REPLAY Rotary Switch for Replay Level as listed immediately below.
Add-A-Ball — Set PROG SW1, toggle 8, to OFF, then adjust REPLAY Rotary Switch for Add-A-Ball Level below.

REPLAY LEVEL SETTINGS

REPLAY Rotary Switch	First Replay Level	Second Replay Level[7]
0	NONE	NONE
1	120 000	160 000
2	140 000	180 000
3	160 000	200 000
[8] $ 4	180 000	220 000
5	200 000	240 000
6	220 000	260 000
7	230 000	280 000
8	250 000	300 000
[9] 9	270 000	320 000
10	290 000	340 000
11	310 000	360 000
12	330 000	380 000
13	350 000	400 000
14	370 000	420 000
15	390 000	440 000

ADD-A-BALL LEVEL SETTINGS

REPLAY Rotary Switch	First Add-A-Ball Level	Second Add-A-Ball Level[7]
0	NONE	NONE
1	120 000	190 000
2	140 000	210 000
3	160 000	230 000
4	180 000	250 000
5	200 000	270 000
6	220 000	290 000
7	230 000	310 000
8	250 000	330 000
9	270 000	350 000
10	290 000	370 000
11	310 000	390 000
12	330 000	410 000
13	350 000	430 000
14	370 000	450 000
15	390 000	470 000

NOTE ($) [7] Both First and Second Replay or Add-A-Ball Levels active if PROG SW1, toggle 3, is ON. Only First Replay or Add-A-Ball Levels active if PROG SW1, toggle 3, is OFF.
[8] Suggested REPLAY Rotary Switch setting for 3-ball game.
[9] Suggested REPLAY Rotary Switch setting for 5-ball game.

EXTRA BALL SEQUENCE REWARD SETTINGS

$ Extra Ball — Set PROG SW1, toggle 2, to ON
25,000 points — Set PROG SW1, toggle 2, to OFF

BALLS PER GAME SETTINGS

$ 3 BALL — Set PROG SW2, toggle 1, to OFF
5 BALL — Set PROG SW2, toggle 1, to ON

MATCH FEATURE SETTINGS

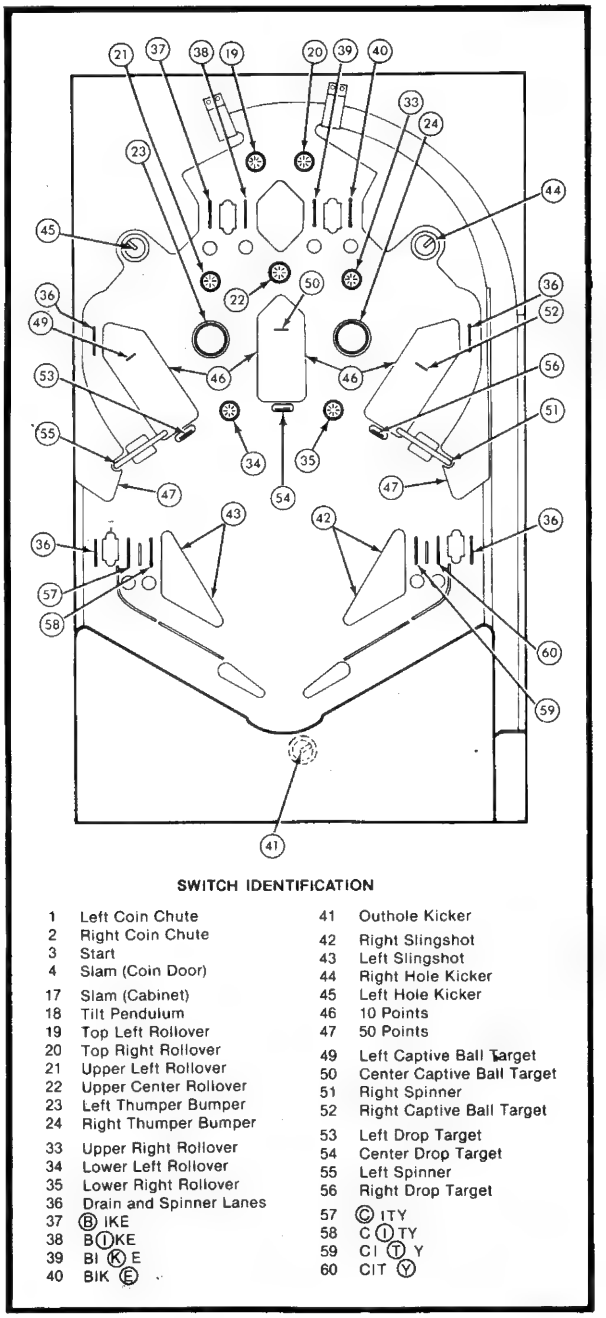
$ Match ON — Set PROG SW2, toggle 2, to ON
Match OFF — Set PROG SW2, toggle 2, to OFF

"SPECIAL" FEATURE DIFFICULTY SETTINGS

$ Liberal (Special lights when all Captive Ball Targets are hit) - Set PROG SW1, toggle 4, to ON
Conservative (Special lights when all Captive Ball Targets are hit and all Drop Targets are down) - Set PROG SW1, toggle 4, to OFF

"SPECIAL" FEATURE AWARD SETTINGS

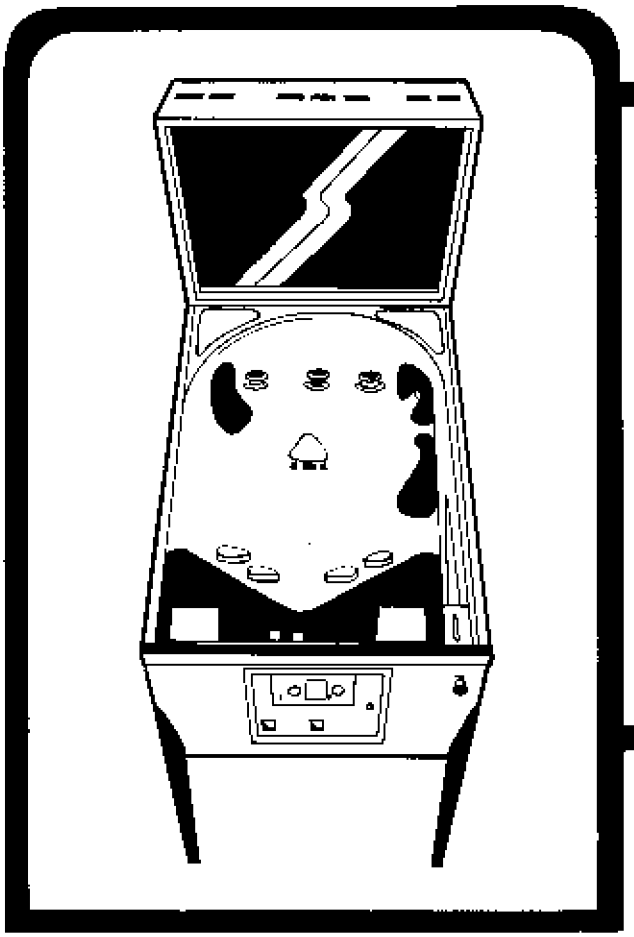
$ Replay — Set PROG SW2, toggles 7 and 8 ON
Extra Ball — Set PROG SW2, toggle 7 ON and 8 OFF
50,000 — Set PROG SW2, toggle 7 OFF and 8 ON
100,000 — Set PROG SW2, toggles 7 and 8 OFF

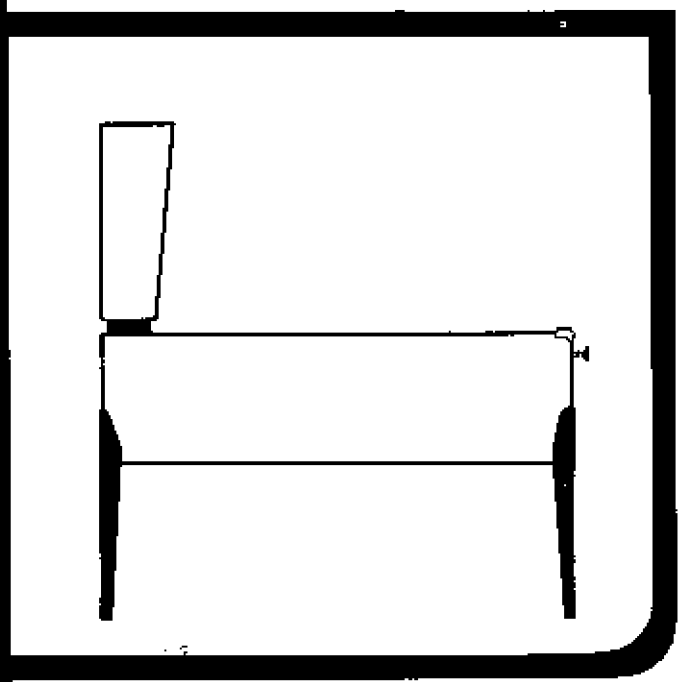


SWITCH IDENTIFICATION

1 Left Coin Chute
2 Right Coin Chute
3 Start
4 Slam (Coin Door)
17 Slam (Cabinet)
18 Tilt Pendulum
19 Top Left Rollover
20 Top Right Rollover
21 Upper Left Rollover
22 Upper Center Rollover
23 Left Thumper Bumper
24 Right Thumper Bumper
33 Upper Right Rollover
34 Lower Left Rollover
35 Lower Right Rollover
36 Drain and Spinner Lanes
37 (B) IKE
38 B(I)KE
39 BI (K) E
40 BIK (E)
41 Outhole Kicker
42 Right Slingshot
43 Left Slingshot
44 Right Hole Kicker
45 Left Hole Kicker
46 10 Points
47 50 Points
49 Left Captive Ball Target
50 Center Captive Ball Target
51 Right Spinner
52 Right Captive Ball Target
53 Left Drop Target
54 Center Drop Target
55 Left Spinner
56 Right Drop Target
57 (C) ITY
58 C (I) TY
59 CI (T) Y
60 CIT (Y)

Figure 1-5 Playfield Switch Locations



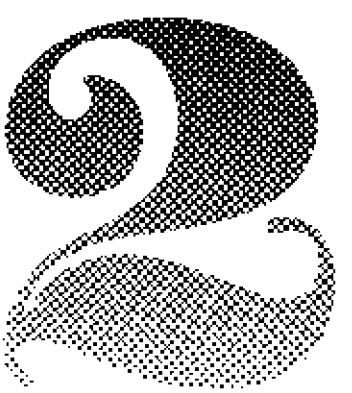


GAME PLAY

The game has three modes of operation: attract, play, and Self-Test. The attract mode serves to attract players to the game. The play mode is active when the game is being played. Self-Test is used by the operator for game maintenance.

A. ATTRACT MODE

The attract mode is initiated by game power-up, exit from Self-Test, or by the end of the previous game. If entered from power-up or Self-Test, the Score and Match/Credit Displays will indicate all eights. If the attract mode follows a game, the score will indicate the final score of that game. When the game is powered up, or exited from the test mode, the display will go blank after approximately 60 seconds. After the end of a game, the machine will sequence through each player's score.



In the attract mode, the playfield lamps blink on and off in an exotic light show that attracts potential players to the game. The game remains in this mode until a player presses the START button (if there are sufficient accumulated credits) or by the operator entering the Self-Test mode by pressing the TEST pushbutton.

B. PLAY MODE

After a player has depressed the START button, the game responds as follows:

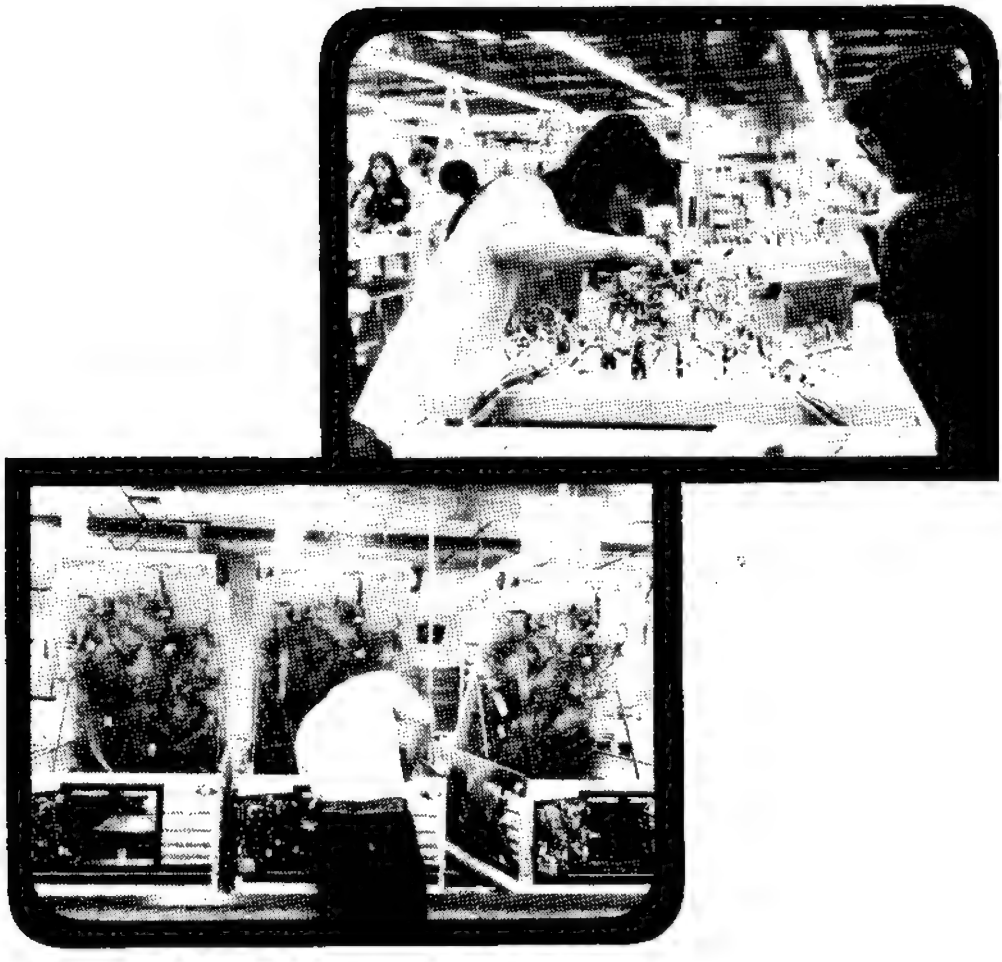
1. The top row in the Score Display Panel indicates two zeros, and 1ST UP to the right of the zeros starts to blink on and off.
2. The number in the Credit Display decreases by one.
3. The Match/Credit Display now displays the number 1, representing the first ball in play.
4. The ball is ejected from the out-hole and rolls over to the ball shooter.
5. The playfield stops blinking. The rollovers are lighted, rollthru lanes labeled BIKE and CITY are lighted. All other playfield lamps are unlighted.
6. The flipper controls are enabled.

Additional players may join the game any time before the last "UP" player's first ball drops into the out-hole. This is done by depositing the necessary coins (if necessary), then depressing the START button. Each time the game responds by adding another row of two zeros in the Score Display Panel and decreasing the Credit Display indication by 1.

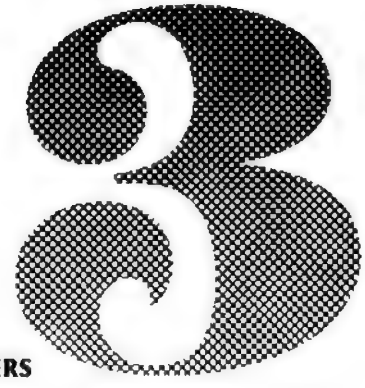
C. GAME PLAY

1. All scoring is as shown on playfield.
2. Completing B-I-K-E or C-I-T-Y lights "DOUBLE BONUS". Completing B-I-K-E and C-I-T-Y lights "TRIPLE BONUS". These lanes are on memory from ball to ball until completed.
3. Star Rollovers increase value of Drop Targets.
4. When the center Drop Target is down, one of the two Thumper Bumpers lights. When the left or right Drop Target is down, the adjacent Spinning Target lights.
5. When all three Drop Targets are down, one of the two Kick-Out Holes lights for "EXTRA BALL". When all three Captive Targets are completed (liberal), one of the two Kick-Out Holes lights for "SPECIAL" (conservative also requires all Drop Targets to be down).
6. Drop Targets are reset whenever the ball enters either Kick-Out Hole.
7. A lighted Thumper Bumper, "EXTRA BALL" or "SPECIAL" alternates left and right, whenever a Slingshot is contacted.

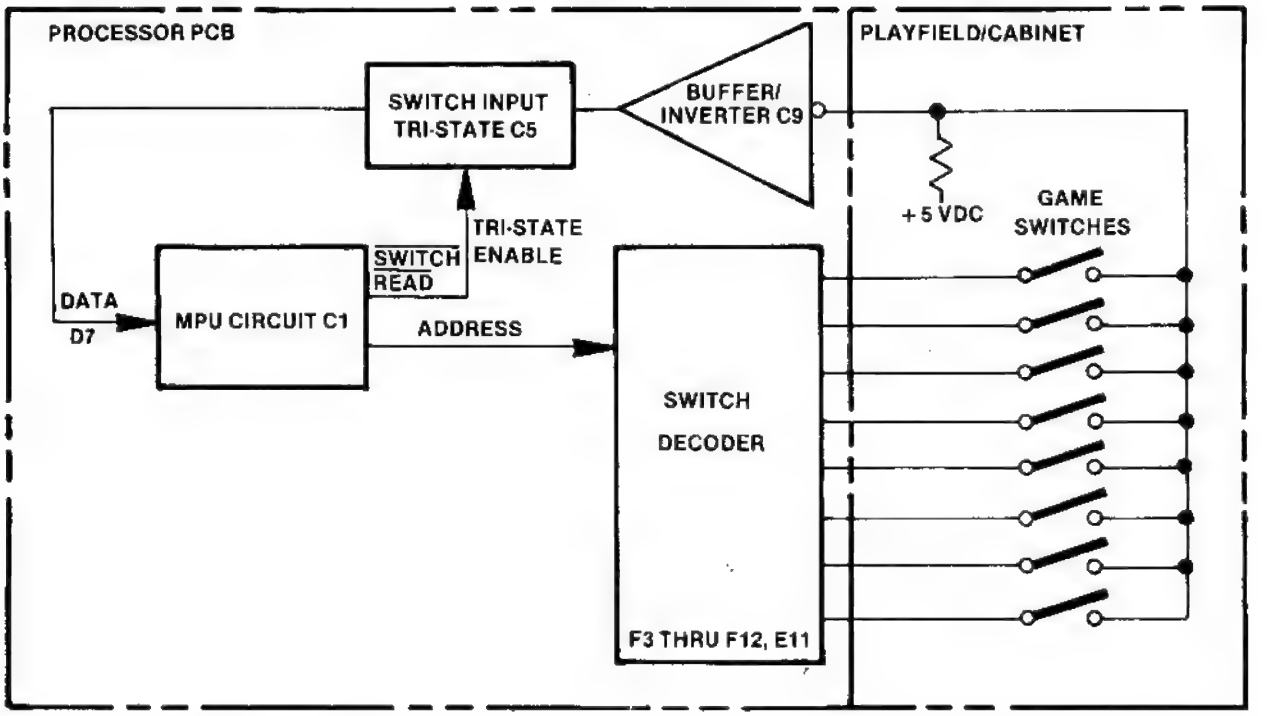
CONDENSED DETAILS OF ELECTRONIC OPERATON



This chapter is a simplified version of the details of operation presented in a block diagram format. Chapter 4 expands the details of electronic operation using the schematic diagrams as a basis for discussion. Therefore, this chapter deals more with the "total picture" of electronic operation, while Chapter 4 deals more with the individual circuits.

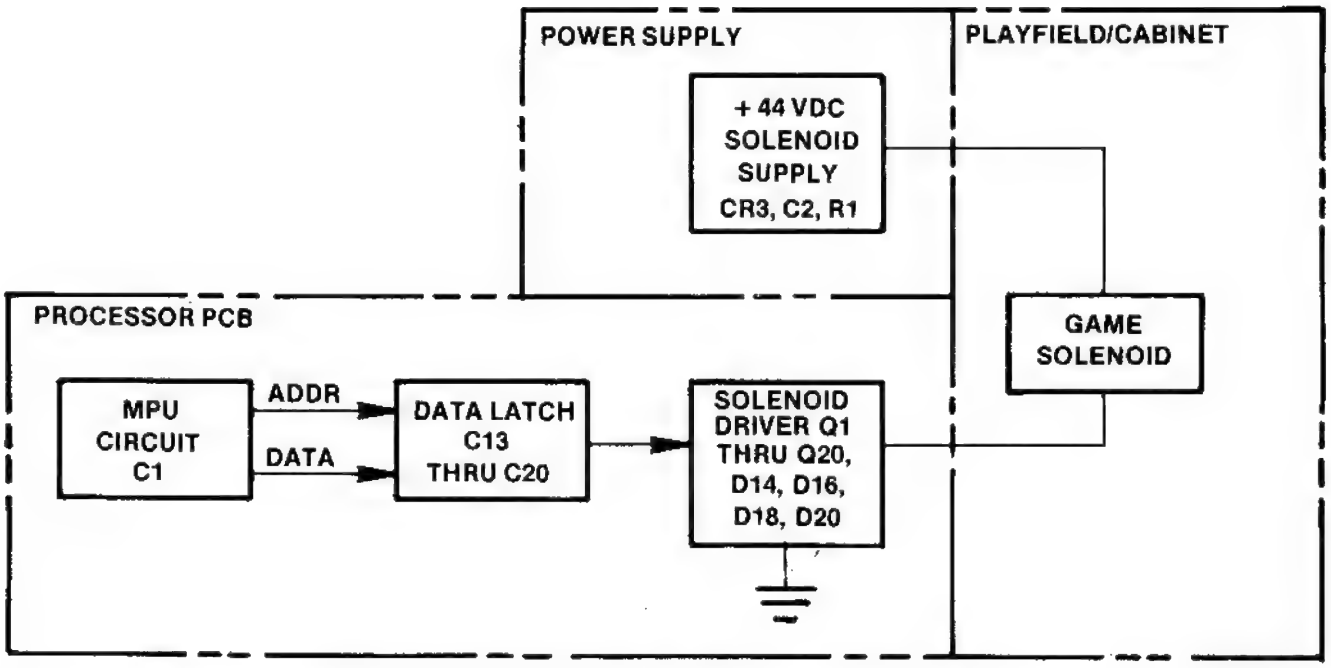


A. SWITCH CIRCUITRY



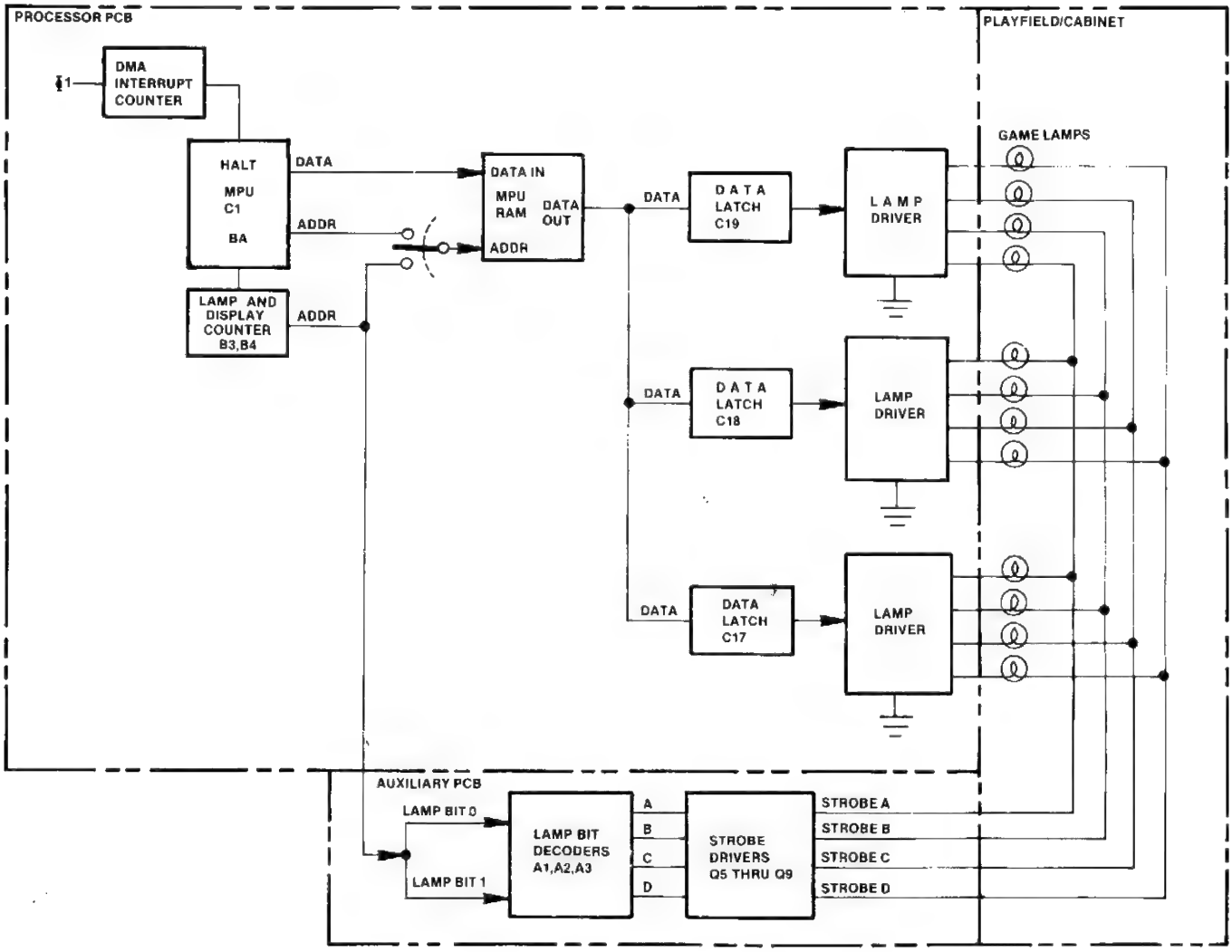
1. MPU CIRCUIT outputs address to SWITCH DECODER.
2. SWITCH DECODER outputs uniqually timed pulse to each GAME SWITCH.
3. If a GAME SWITCH is closed, uniqually timed pulse passes through switch.
4. SWITCH INPUT TRI-STATE passes "closed switch" information to MPU CIRCUIT on data line D7.
5. MPU CIRCUIT receives "closed switch" information and identifies switch by its unique timing.

B. SOLENOID CIRCUITRY



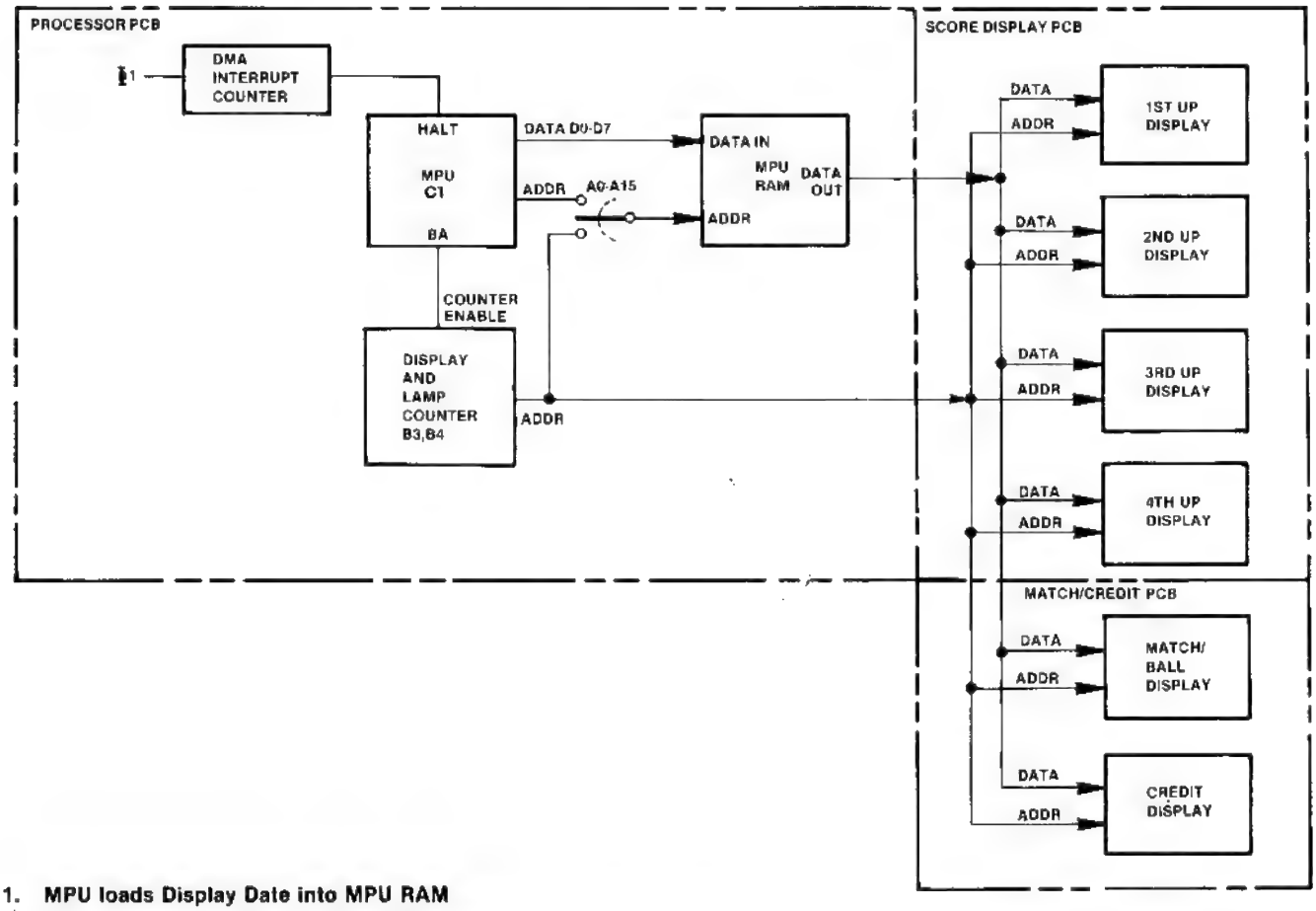
1. MPU CIRCUIT outputs address and sets DATA LATCH with high data input for "turn on solenoid" command.
2. DATA LATCH outputs high "turn on solenoid" signal to selected SOLENOID DRIVER (defined by address input).
3. SOLENOID DRIVER output creates current path to ground for selected GAME SOLEOID.
4. GAME SOLENOID is turned on, due to +44VDC from POWER SUPPLY and ground path thru SOLENOID DRIVER.

C. LAMP CIRCUITRY



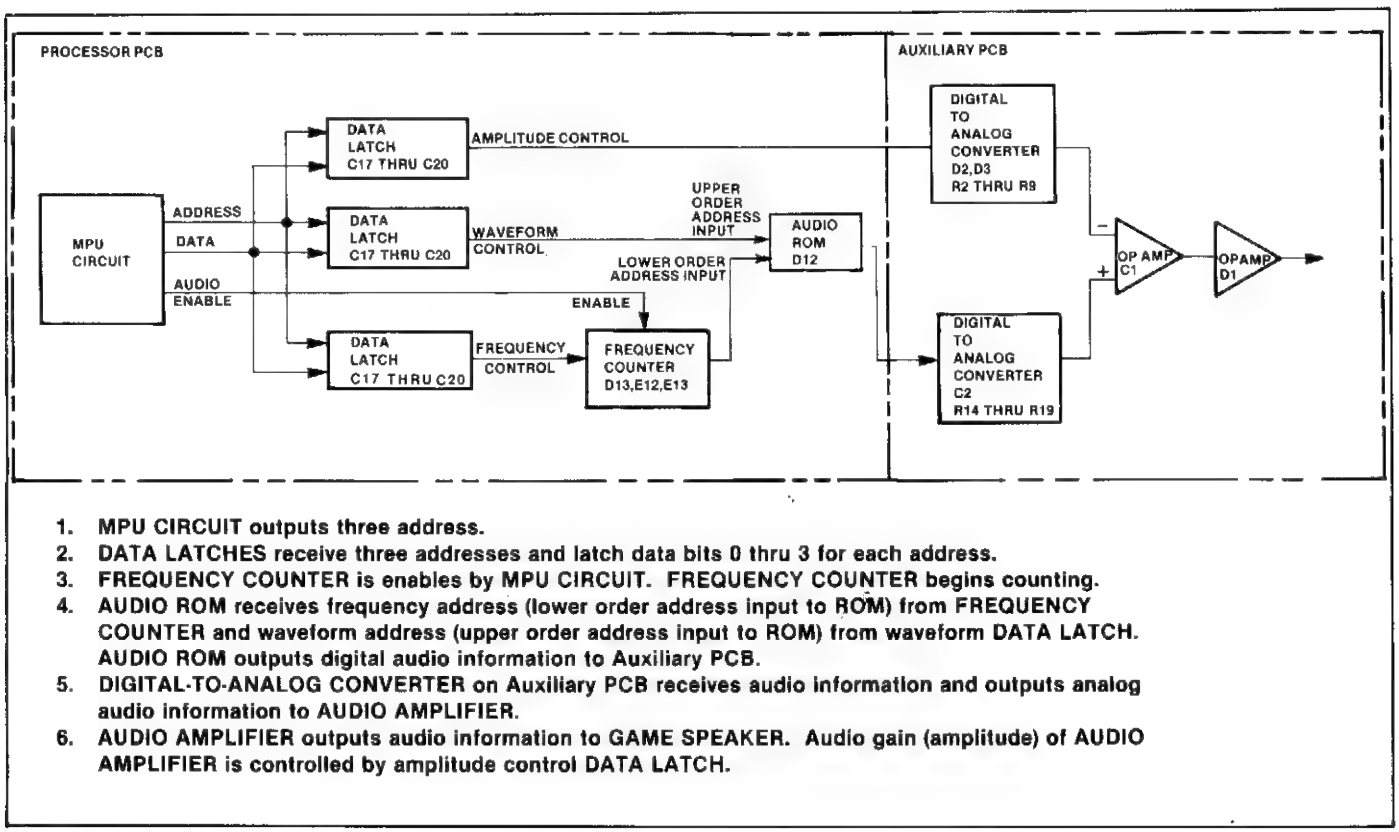
1. MPU loads Lamp Data into MPU RAM
2. MPU receives DMA interrupt
3. MPU halts and outputs BA (Bus Available) signal to DMA circuit
4. Lamp and Display Counter is enabled and outputs address to appropriate Lamp Data Latches and to the MPU RAM (Lamp Counter's addresses are temporarily inserted onto the MPU Address Bus).
5. Lamp update information is transferred from MPU RAM to appropriate Lamp Data Latches.
6. Data Latch outputs a high "light lamp" signal to selected Lamp Driver
7. Lamp and Display Counter outputs Lamp Bit data to Auxiliary PCB Lamp Bit Decoders
8. Auxiliary PCB outputs one of four STROBE signals to game lamps
9. Game lamps connected to active STROBE signal is lighted, due to ground path, through selected Lamp Driver

D. SCORE AND MATCH/CREDIT DISPLAY CIRCUITRY



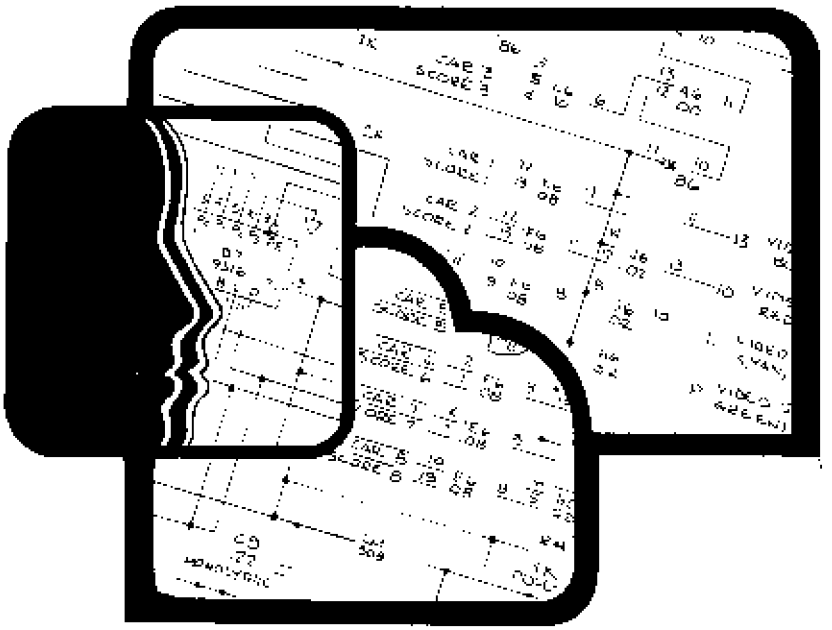
1. MPU loads Display Date into MPU RAM
2. MPU receives DMA Interrupt (every 500 μsec.)
3. MPU halts and outputs BA (Bus Available) signal to Display Circuit
4. Display Counter is enabled and outputs address to appropriate display and to MPU RAM (Display counter's addresses are temporarily inserted onto the Address Bus).
5. Display update information is transferred from MPU RAM to appropriate display

E. AUDIO CIRCUITRY



1. MPU CIRCUIT outputs three address.
2. DATA LATCHES receive three addresses and latch data bits 0 thru 3 for each address.
3. FREQUENCY COUNTER is enables by MPU CIRCUIT. FREQUENCY COUNTER begins counting.
4. AUDIO ROM receives frequency address (lower order address input to ROM) from FREQUENCY COUNTER and waveform address (upper order address input to ROM) from waveform DATA LATCH. AUDIO ROM outputs digital audio information to Auxiliary PCB.
5. DIGITAL-TO-ANALOG CONVERTER on Auxiliary PCB receives audio information and outputs analog audio information to AUDIO AMPLIFIER.
6. AUDIO AMPLIFIER outputs audio information to GAME SPEAKER. Audio gain (amplitude) of AUDIO AMPLIFIER is controlled by amplitude control DATA LATCH.

DETAILS OF ELECTRONIC OPERATION



A. PROCESSOR PCB

Since the Processor PCB is the most complex, the individual circuits are isolated in the schematic diagrams of Figures 3-2 thru 3-7. Figure 3-1 illustrates the isolated circuits to aid you in locating them on the actual PCB. The details of operation of this PCB are arranged to follow the schematic layout.

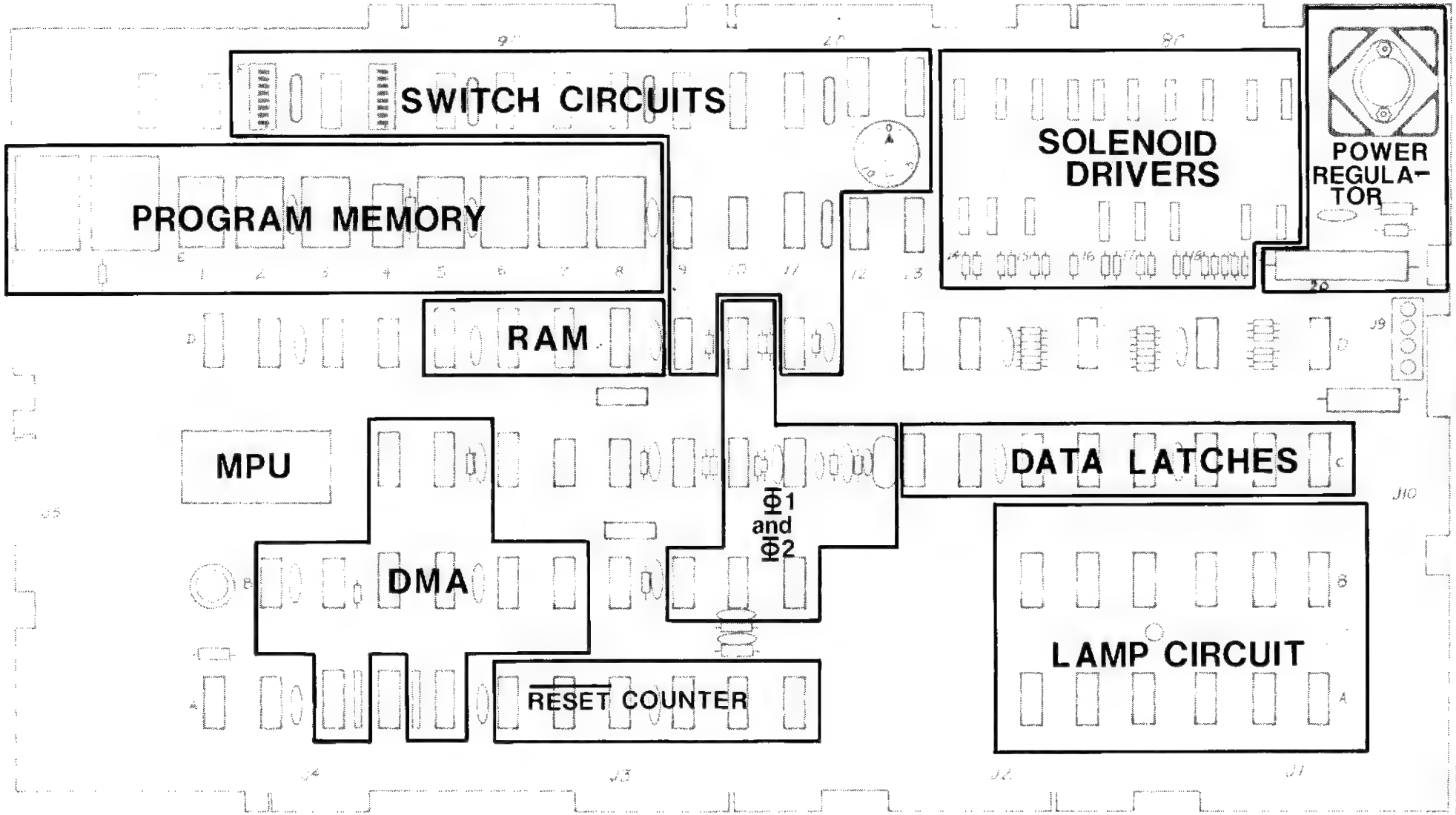


Figure 4-1 Processor PCB Circuit Layout

1. MPU Circuitry—See schematic, Figure 4-2

The heart of the Processor PCB is the microprocessor circuitry. A brief discussion of the major components and their function in the microprocessor circuitry is provided in the following paragraphs. Note that these components include:

- the MPU (C1), its address and data buffers, its ROM memory (E00 through E8, and its RAM memory (D5 through D8)
  its address decoding circuitry (C6, D1, and miscellaneous gates)
- its Φ1 and Φ2 clock drivers (C11, B9, B10 and miscellaneous gates)
- its RESET and INTERRUPT timing counters (A6 through A11 and miscellaneous gates)
- its DMA circuitry (B2 through B8, B10, C4, C5, and miscellaneous gates).

a) MPU, ROM and RAM

The microprocessor is the "master controller" of all action that takes place in the game circuitry. Upon initialization, the MPU addresses data permanently stored in the Program ROMs (E00 through E8). This addressed data then travels to the MPU via its 8-bit data bus (D0 through D7). The MPU decodes this data to determine what action it is to perform next, i.e., "read coin switch 1," "turn on lamp 43," etc. The MPU uses RAM memory (D5 through D8) to perform many of these instructions. It uses the RAM as a temporary storage space for information which it will later need to recall. The MPU is capable of writing (or putting data into) the RAM and then later reading (or pulling data out of) the RAM, via its address bus (A0 through A15) and bi-directional data bus (D0 through D7).

b) Address Decoding

The MPU address decoding circuitry performs the critical function of "turning on" or enabling the appropriate game circuitry (i.e., RAM, ROM, latches, etc.) at the appropriate time. Therefore, the information can be transferred back and forth between the game circuitry and the MPU.

c) Φ1 and Φ2 Clock Drivers

The basic operating frequency of the microprocessor is established by the Φ1 and Φ2 clock inputs (on pins 3 and 37). All Atari Pinball PCBs run at an operating frequency of 1 MHz. Examining the Φ1 and Φ2 wave forms with an oscilloscope will show two signals of opposite polarity with a period of 1 microsecond. (The period of a waveform is a measurement of the time of one complete cycle of that waveform.) The 1-MHz clock frequencies are derived from a 4-MHz crystal-controlled oscillator. This 4-MHz frequency is "divided-by-four" by counter C11 and flip-flop B9 and pre-shaped by timer B10.

d) RESET and INTERRUPT Timing Counters

The reset and interrupt timing counters in the microprocessor control circuitry consist of six stages of 4-bit binary counters (A6 through A11). These counters serve a multi-purpose function, by dividing down the MPU's clock frequency into various timing signals.

The first stage of the counter chain, A6, is clocked at a rate of 1 MHz (by Φ1). This stage's Q_A output (DMA CLK) is used as the basic timing frequency for the DMA circuit, and runs at 500 KHz (period = 2 microseconds).

The Q_C output of A6 (AUDIO CLK) is used as the basic timing frequency for the audio control circuitry. It runs at 125 KHz (period = 8 microseconds).

The Q_D output of A8 is used to clock counter A11. The Q_B output of A11 occurs at a frequency of approximately 60 Hz, or about every 16 milliseconds. This output is gated onto the MPU data bus line D6, by the $\overline{\text{SWITCH READ}}$ address decode. The MPU program uses this information during its switch reading routine, to time out or "debounce" any switch closures which it has recognized.

The final function of these counter stages is sending the $\overline{\text{RESET}}$ signal to the MPU. This signal hopefully occurs at a frequency of 0, or in other words, never. Counters A9 and A10 count how many times the Q_D output of counter A8 changes states. Meanwhile, the WAKE-UP RESET signal, generated at various points during the MPU's normal instruction sequence, is resetting these same counters (A9 and A10) back to a count of zero. If for some reason the MPU program has strayed from its normal instruction sequence, and WAKE-UP RESET does not occur before these counters count up to the point where the Q_B output of A10 goes high, a $\overline{\text{RESET}}$ signal is generated to the MPU, causing it to restart its instruction sequence from the beginning.

NOTE

If troubleshooting the MPU circuitry, we normally recommend disabling this reset-generating circuitry until any other problems have been fixed. This disabling is most easily done by cutting and lifting pin 6 of F1.

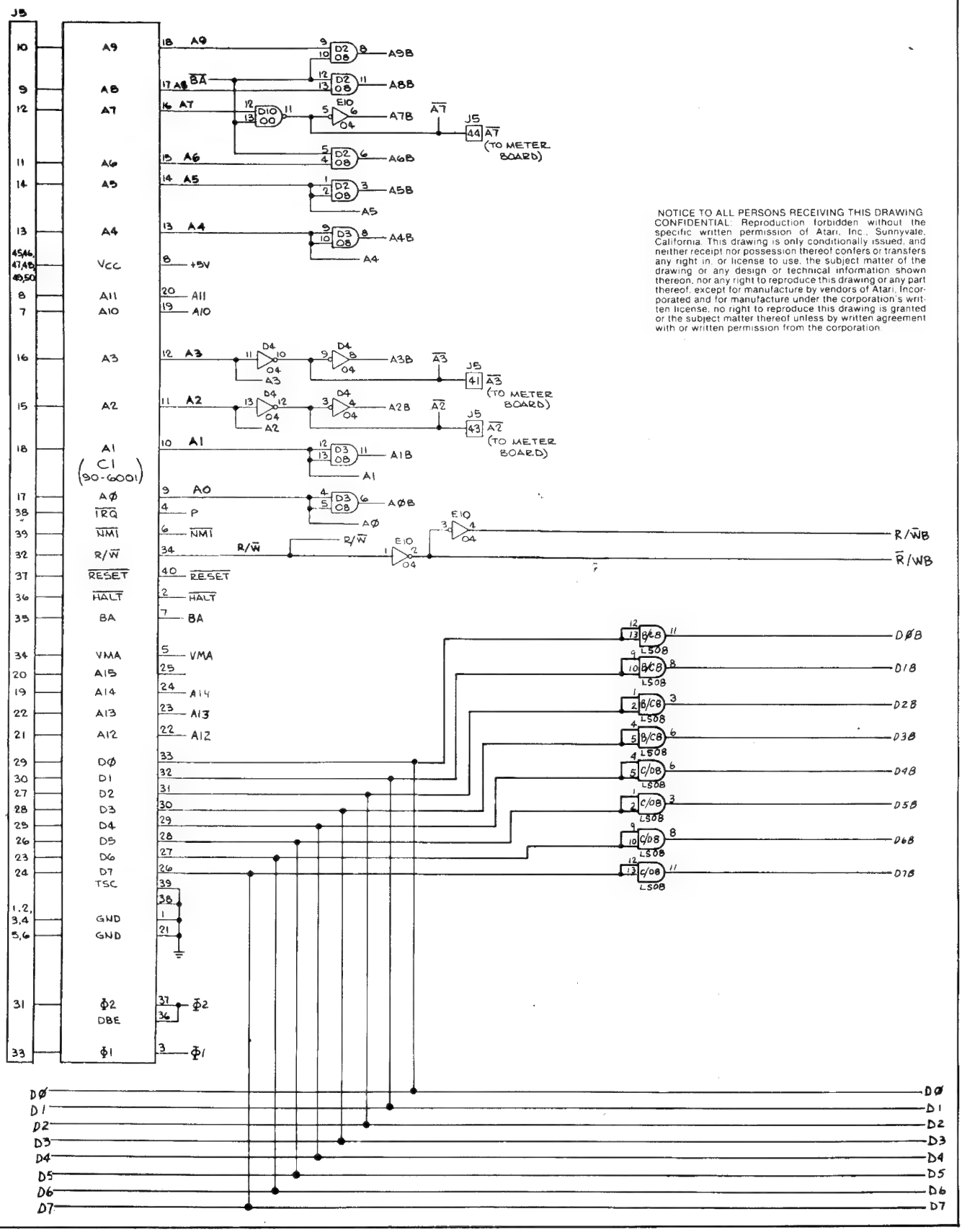


Figure 4-2 Microprocessor Circuitry

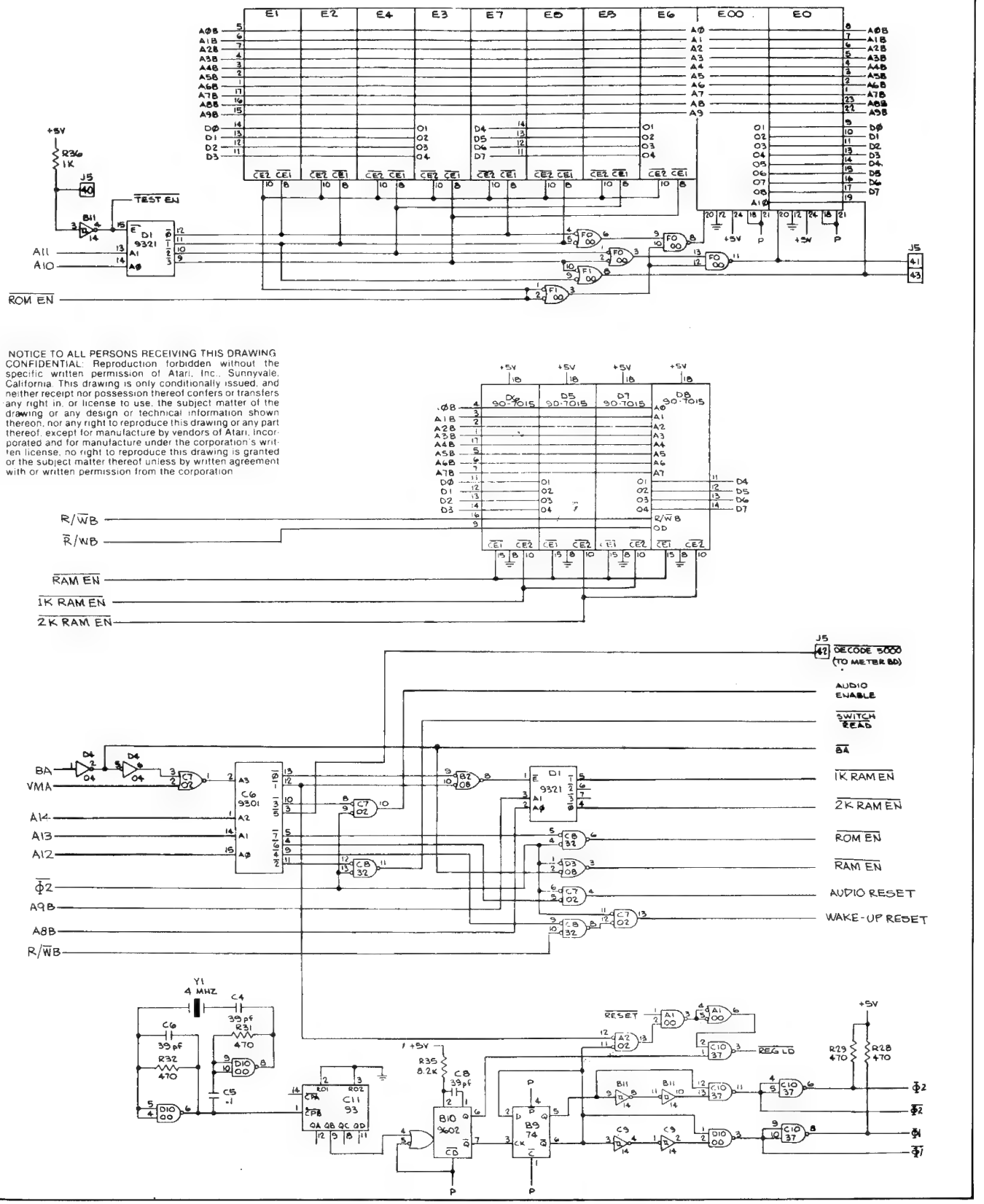


Figure 4-2 Microprocessor Circuitry

e) DMA (Direct Memory Access)

Direct Memory Access is a term used to describe the circuitry, peripheral to the MPU, temporarily taking control of the MPU's address and data bus to gain direct access to some portion of the MPU's RAM memory. As you already know, the microprocessor controls the game operation. It flashes lamps during the ATTRACT mode, recognizes coin inputs, senses playfield switch closures, operates game lamps and solenoids, and does the "bookkeeping" for player score information. The MPU, in performing these tasks, directly "reads" all switch inputs and directly "writes" on/off information to all audio, coil, and solenoid output latches. The MPU, however, does not transfer lamp and score information to the respective lamp and score latches. Instead, the MPU stores the lamp on/off and player score information in selected locations in its RAM memory. Then, at regular intervals (every 512 microseconds) the game circuitry halts the MPU and inserts lamp and score display addressing information onto the MPU address bus. This addressing information is configured so that it accesses the selected RAM cells where lamp and score information has been stored by the MPU. The RAM output data is then used to update the lamp data latches and lamp strobes, the four score displays, and the Match/Credit display. The following paragraph goes into the details of the timing of the game circuitry's access to the MPU RAM memory, and how it uses the information that the MPU has stored in that memory.

Every 512 microseconds a $\overline{\text{DMA INT}}$ signal is generated by the reset and interrupt timing counters. This initiates the DMA interrupt routine. One $\overline{\text{DMA CLK}}$ pulse after the $\overline{\text{DMA INT}}$ goes low, the Q output of the Halt flip-flop (B6, pin 8) generates a HALT signal to the MPU. The MPU responds by finishing its current instruction cycle, and then signaling that it has stopped and relinquished control of its address and data bus, by outputting a high on its BA (Bus Available) output line. BA going high (and BA going low) then generates the LD, $\overline{\text{LD}}$, ANODE BLANK, and $\overline{\text{CATHODE BLANK}}$ signals and also turns on the tri-state address bus drivers C4 and C5. The access to the MPU RAM is now ready to take place, via address lines A0 through A5 and A12 through A14.

For the next several microseconds, these address lines are controlled by the outputs of counters B3 and B4. They address the respective cells in RAM memory that contain the lamp and display update information. Counters B3 and B4 are both clocked by the basic DMA timing frequency, DMA CLK, at a frequency of 500 KHZ. The Q_A output of B3 (clocked by the CP_A input on pin 14) runs at half of this frequency. This divide-by-two effect inhibits counter B4 from counting on every other (or alternate) DMA CLK pulse. It also triggers the $\overline{\text{LOAD DISPLAY}}$ one-shot timer (B10) for every other DMA CLK pulse. This alternate-cycle loading of display information, via one-shot B10, is done so that display update data (from the MPU RAM which is being addressed by counters B3 and B4) has time to stabilize before it is actually loaded into the displays. The CP_B clock input of counter B3 (pin 1) is clocked once per each DMA interrupt cycle (by the falling edge of $\overline{\text{LD}}$). The Q_B, Q_C, and Q_D outputs of B3 indicate to the RAM, as well as to the display, which of the seven display digits (via DISPLAY ADDRESS 0, 1, and 2) is currently being updated. (Please note that the Q_B and Q_C outputs of counter B3 are also used to generate the lamp strobe bits, LAMP BIT 0 and LAMP BIT 1. See Lamp Output Circuitry description.)

Therefore, one of the seven display digits and one of the four sets of lamps is updated each DMA interrupt cycle. Counter B3 determines *which* of these is updated. Counter B4 determines *what* information this display digit or set of lamps is updated with. Counter B4 counts from a count of 0 (all outputs low) at the beginning of each DMA interrupt, to a count of 15 (all outputs high), which signals the end of the interrupt. The 16 possible combinations on the Q outputs of B4 are used to address 16 locations in RAM (via A2, A3, A4, and A5). The information contained in these RAM locations is used as follows: 1) four locations contain lamp update information (when B4, Q_A, and Q_B outputs are both high); 2) four locations contain the four players' score information (when Q_A and Q_B outputs are both low); 3) four locations contain Match/Credit update information (when Q_A output is low and Q_B output is high); and 4) four locations are not used.

When Counter B4 has counted through all 16 locations and all appropriate lamps and display digits for that DMA interrupt cycle have been updated, a "terminal count" pulse is generated at B4 pin 15. This pulse causes the HALT flip-flop (B6) to toggle, causing $\overline{\text{HALT}}$ to go high. The MPU now recognizes that the DMA cycle has finished, responds by outputting a low on its BA (bus available) line, then continues on in its normal instruction sequence from where it left off before the DMA interrupt began. Approximately 500 microseconds from this time, the MPU will receive its next DMA interrupt. It will then repeat the identical procedure, except that it will update a different display digit and set of lamps from the previous interrupt cycle. (Remember, the Q_B, Q_C, and Q_D outputs of B3 are only clocked once per interrupt cycle; therefore every succeeding cycle will update the next sequential display digit or set of lamps.)

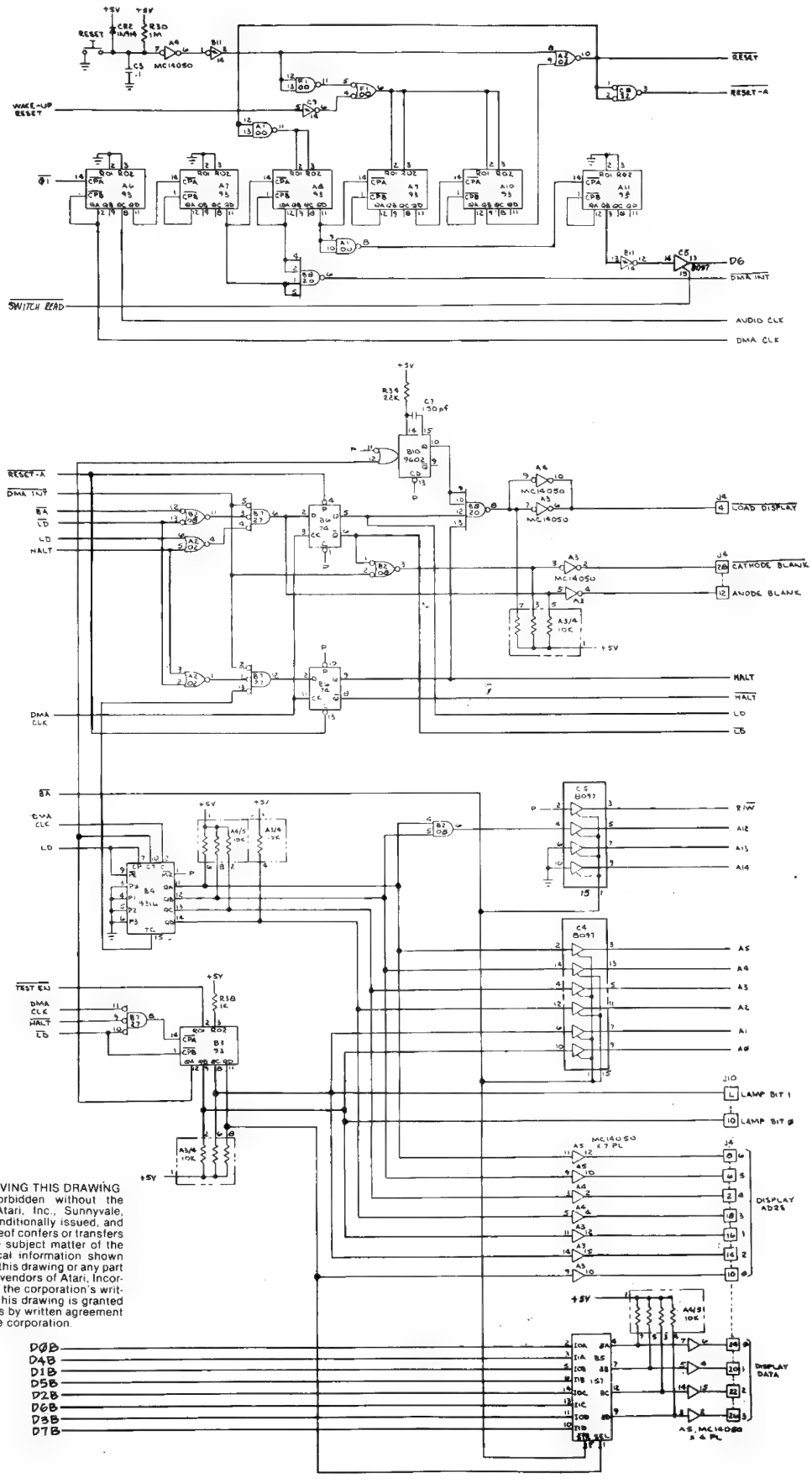


Figure 4-2 Microprocessor Circuitry

Since there are four sets of lamps, and one set is updated each interrupt cycle, each set is updated every fourth cycle, or every 2 milliseconds (4 x 500 microseconds = 2 milliseconds). In contrast, there are seven display digits. Each of these digits is updated every eighth interrupt cycle, or every 4 milliseconds (8 x 500 microseconds = 4 milliseconds). Though the DMA interrupt cycle, when viewed as a complete routine, is a seemingly complicated process, it is actually a large number of very simple operations happening in a very short amount of time.

2. Switch Reading Circuitry—See schematic, Figure 4-3

The MPU's switch-reading circuitry is relatively simple and straight-forward. One side of all playfield and game PCB switches is bussed together into a single SWITCH COMMON line, which goes to the MPU data bus line D7, via edge connector J7, pins 5 and 6. The other side of each of these normally-open, single-pole, single-throw switches is connected to its own unique output of an open-collector one-of-eight decoder (F3 through F13), via edge connectors J6 and J7.

To determine if any given switch is being actuated, the MPU puts out the unique address that has been assigned to that switch on its address lines. (Note that the MPU hexadecimal address of each switch is listed on the right hand side of the schematic.) This MPU address is decoded by one-of-ten decoder E11 and one-of-eight decoders F3 through F13 to provide a low pulse to the appropriate switch. Simultaneous to outputting this address, the MPU also "reads" data bus line D7, via the $\overline{\text{SWITCH READ}}$ enabling signal to tri-state buffer, C5. If a switch is actuated (or closed), the low pulse caused by the one-of-eight decoder will be seen by data line D7 via the SWITCH COMMON line.

NOTE

When troubleshooting the switch-reading circuitry, we recommend you begin by troubleshooting the SWITCH COMMON line. With all switches open (including the on-board option switches, F2 and F4), the SWITCH COMMON line should be a constant high. If not, first check to see if you have any shorted playfield or PCB switches.

3. Lamp Output Circuitry—See schematic, Figure 4-4

All MPU-controlled lamps are powered by one of the four lamp strobes. Each of these four lamp strobes is connected to a string of several lamps. (See game wiring diagram to determine which lamps are connected to which strobes.) The actual lamp strobes are generated by the Auxiliary PCB, but are controlled by the Processor PCB via LAMP BIT 0 and LAMP BIT 1. The two bits of data indicate to the Auxiliary PCB which of the four lamps strobes to turn on. (Note that these two lamp bits are a function of counter B3, as previously discussed under DMA. These two bits count up in a binary sequence with each DMA interrupt, every 500 microseconds.) Each "set" of lamps has power applied to one "side" of each individual lamp every 2 milliseconds for a duration of approximately 500 microseconds. The other "side" of each individual lamp is connected to its own unique lamp driver (A15 through A20 and B15 through B20) on the Processor PCB via edge connector J1 and J2. These 2003A lamp drivers merely provide a current path to ground for any lamp which is to be turned on. The lamp driver's on/off status is controlled by the outputs of data latches C13 through C20. These data latches are updated with the proper lamp information every 500 microseconds by the DMA interrupt sequence previously discussed.

NOTE

The 9 data latches (C13 through C20) are used for storing control information for both the lamp driver and solenoid driver circuitry. For this reason, the data latches are schematically shown on both Figures 3-4 and 3-5. It should be noted, however, that only latch outputs Q4, Q5, Q6, and Q7 are used for controlling lamp drivers, while latch outputs Q0, Q1, Q2, and Q3 are used to control solenoid drivers.

4. Solenoid Output Circuitry—See schematic, Figure 4-5

The solenoid output circuitry is very straightforward. To turn a solenoid on at the appropriate time, the MPU writes directly to data latches C13 through C20. The output of these data latches is used to turn on or off the appropriate solenoid drivers, Q1 through Q20. Similar to the lamp driver circuits, the solenoid drivers merely provide a current path to ground. One side of each solenoid is connected to the Solenoid Supply (generated directly from the power supply). The other side of each solenoid is connected directly to its individual driver on the Processor PCB, through edge connector J8.

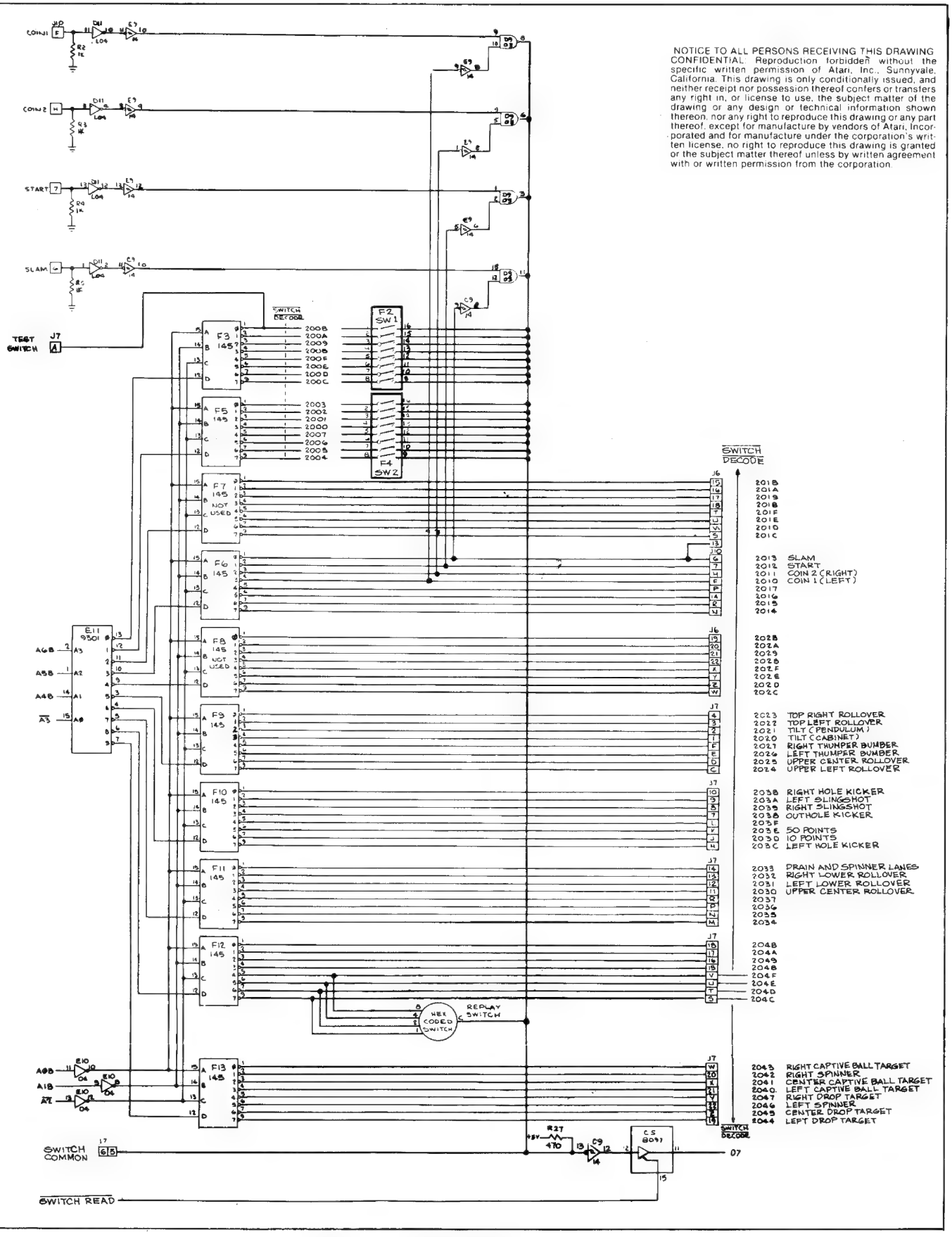


Figure 4-3 Switch Reading Circuitry

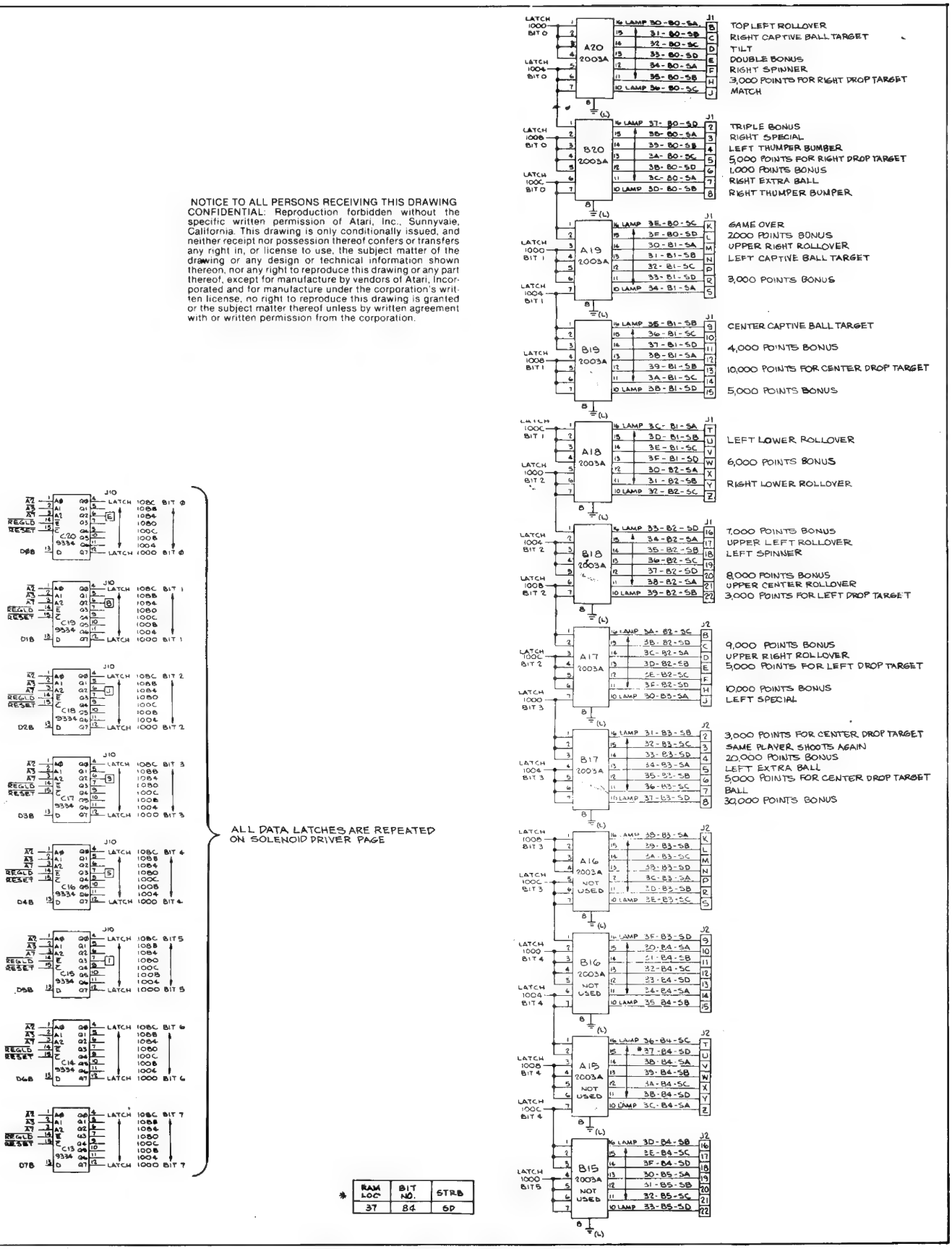


Figure 4-4 Lamp Output Circuitry

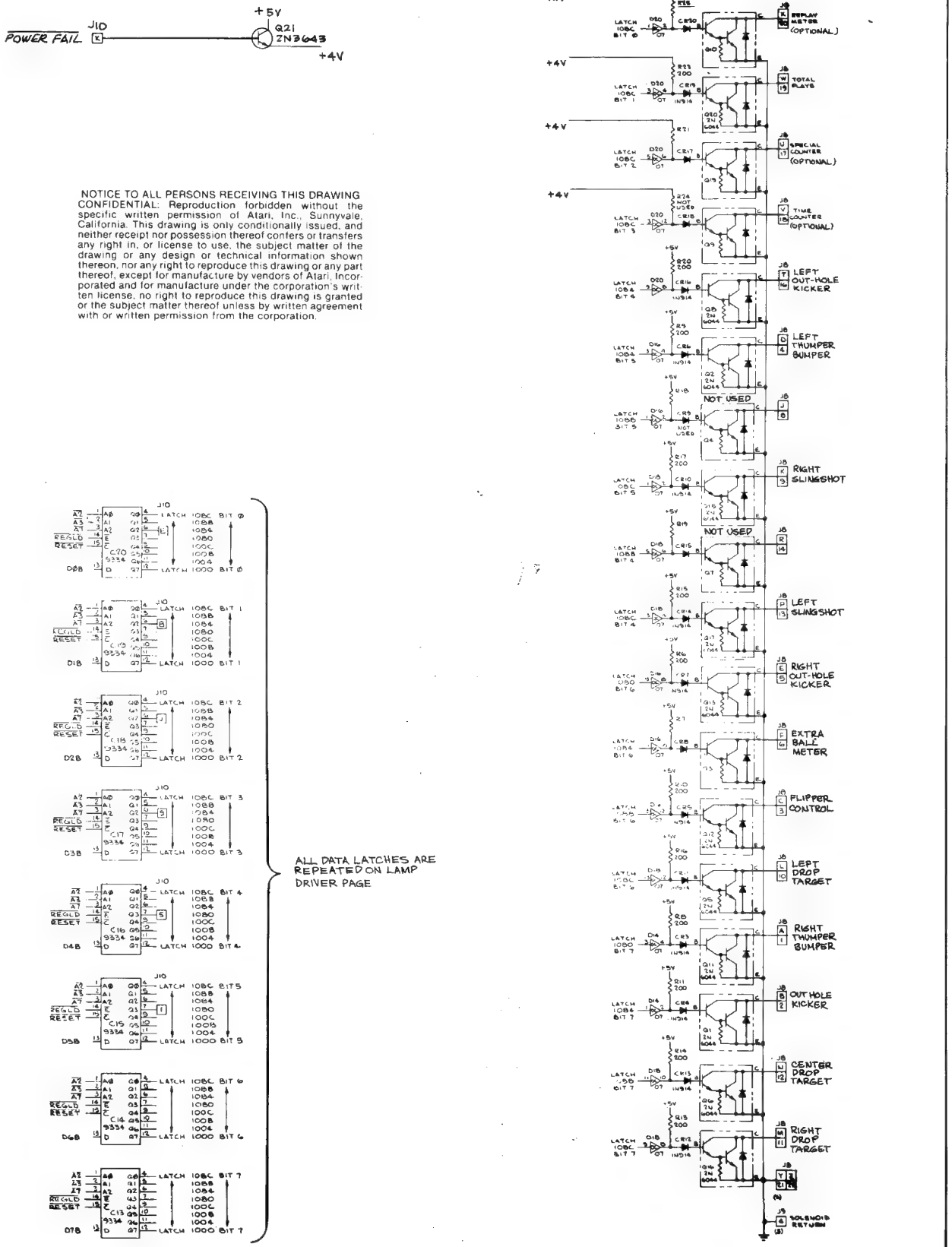


Figure 4-5 Solenoid Output Circuitry

5. Audio Control Circuitry—See schematic, Figure 4-6

Audio signals are generated as digital information on the Processor PCB, then fed to the Auxiliary PCB where the information is converted to an analog signal and amplified.

The Audio Control Circuitry, on the Processor PCB, generates all of the digital audio information via Audio ROM D12. This ROM is programmed at Atari to contain sixteen distinct audio sequences. Each of these sequences consists of thirty-two individual "tones" or notes.

The accessing of this Audio ROM information is controlled by the MPU circuitry. At the appropriate time, the MPU outputs four bits of data (LATCH 1080, BIT0 thru BIT3) to the most significant address inputs of ROM D12. These four bits determine which of the sixteen audio sequences is to be played. The MPU also outputs four bits of data (LATCH 1088, BIT0 thru BIT3) to counter D13. These four bits preset counter D13 to a known state, and thereby determine the frequency at which counters E12 and E13 are clocked. The five outputs of counters E12 and E13 are used as the least significant address inputs to Audio ROM D12. These select which of the thirty-two tones of the sequence is to be played, and also determine the frequency at which these tones are "played"

The output of the Audio ROM, AUD0 thru AUD3 is sent off the Processor PCB to the Auxiliary PCB, where it is converted to analog audio information, and then amplified before being sent to the game speaker. The MPU, again, outputs four bits of data (LATCH 1084, BIT 0 thru BIT3) which control the amount of amplification of the audio signal at any given time.

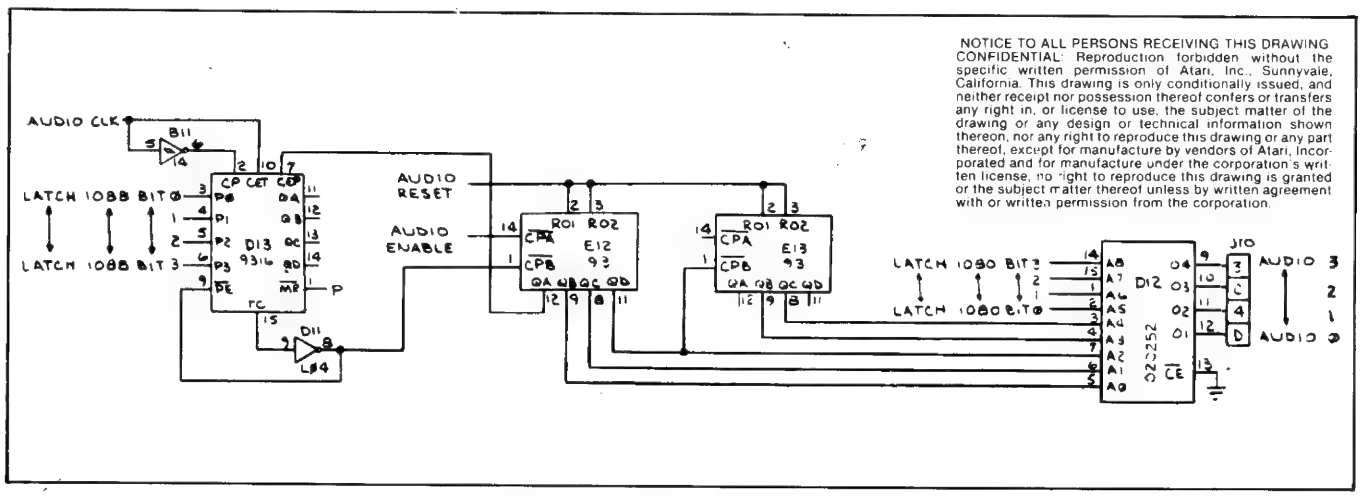


Figure 4-6 Audio Control Circuitry

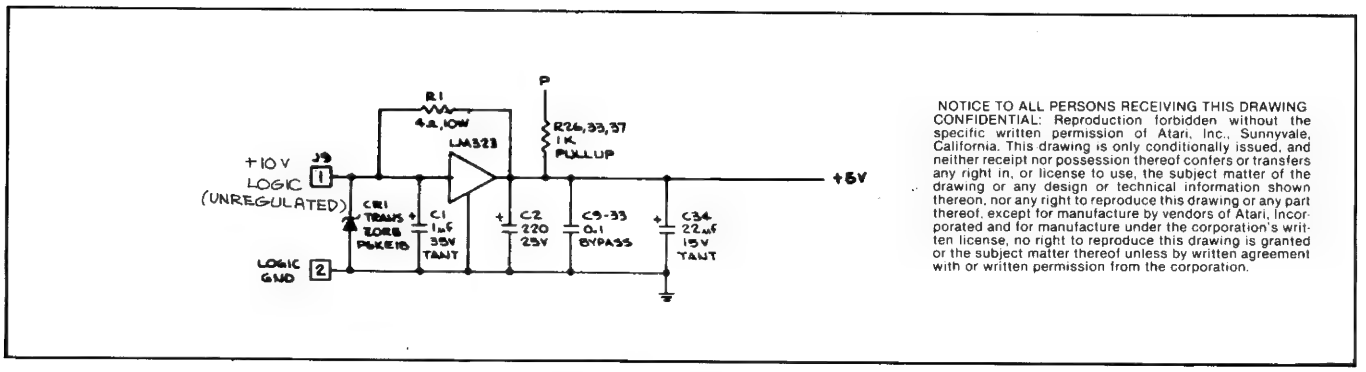


Figure 4-7 Power Circuitry

B. AUXILIARY PCB – See schematic, Figure 4-8

The Auxiliary PCB is in effect an extension of the Processor PCB circuitry. It contains various power-consuming portions of the lamp driver circuitry, the solenoid driver circuitry, and the audio generating circuitry, as well as the audio and display supply voltages.

1. Display Supply

The Display supply is generated from the 170 VAC center-tapped voltage from the game power supply. It is rectified on the Auxiliary PCB to form the +90 V and −90 V DC voltages necessary to power the Score and Match/Credit Displays. Note that this circuitry also includes transistor Q12 as part of the POWER FAIL protection.

2. Miscellaneous Drivers

Drivers for the coin door lockout coil and coin counter coil are also included on this PCB. These two drivers are controlled by latched signals generated on the Processor PCB. Each driver is capable of "energizing" its respective coil by providing a current path through the coil to Auxiliary PCB ground.

3. Lamp Strobes

The Auxiliary PCB also generates four mutually exclusive lamp strobe outputs. These strobes are controlled by the LAMP BIT 0 and LAMP BIT 1 control bits from the Processor PCB. The four lamp strobes should each consistently pulse at a rate of every 2 milliseconds and each pulse should last for a duration of about 500 microseconds. These strobes serve as the "supply voltage" for all MPU-controlled lamps. Since each strobe has an "on" duty cycle of only 25%, even lamps which appear to be on all the time are really only being supplied with power about one-fourth of the time. Since the 25% duty cycle at this frequency is not perceptible to the human eye, this is an efficient way to reduce power consumption as well as prolong lamp life.

As a point of general interest, the Atari "keep-alive" routine will also be mentioned at this time. If you carefully observe any lamps which are supposedly in their "off" condition, you can see a faint pulsing of the lamp filament. This is due to the lamps being turned on and off very quickly at a very low frequency. The effect of this procedure is to prolong lamp life, since it prevents sudden current surges through the lamp filament.

4. Audio Circuit

The game's audio amplifier (D1) is also located on the Auxiliary PCB. The actual audio control circuitry is located on the Processor PCB, where a three-stage MPU-controlled counter (consisting of D13, E12, and E13) is used to address audio PROM D12. The output of this audio PROM (Audio 0 through Audio 3) is then sent to the Auxiliary PCB. A D/A (digital-to-analog) conversion is then performed on these four audio bits, using open-collector gate C2 (7407) and resistors R16 through R19. This analog waveform is then buffered and amplitude modulated by op-amp C1. The output of op-amp C1 is then sent to the audio amplifier through a 5K-Ohm volume adjustment potentiometer. The necessary voltages to power the audio circuitry (+20V, +16V, +13.6V, and +6.8V) are also generated on the Auxiliary PCB.

C. SCORE DISPLAY PCB – See schematic, Figure 4-9

The Score Display PCB receives score update information from the Processor PCB. This information includes 7 bits of Display Address information (Display Address 0 through 6), four bits of Display Data (Display Data 0 through 3), a LOAD DISPLAY signal, a CATHODE BLANK signal, and an ANODE BLANK signal. LOAD DISPLAY is a synchronizing pulse generated by the Processor DMA timing circuit which indicates the timing of the actual updating of Display information from the MPU RAM. If DISPLAY ADDRESS 5 and 6 are both low, this indicates to the Score PCB that the information contained by DISPLAY DATA 0 through 3 is intended for updating the Score Display (as opposed to the Match/Credit Display). DISPLAY ADDRESS 3 and 4 are decoded to determine which player's score is being updated. DISPLAY ADDRESS 0, 1, and 2 are decoded to determine which of the 7 digits of a player's score is being updated. DISPLAY DATA 0 through 3 contain the actual information for updating the appropriate digit of the appropriate player's score. ANODE BLANK and CATHODE BLANK inhibit, or blank, the displays during the time when they are actually being updated by the Processor PCB.

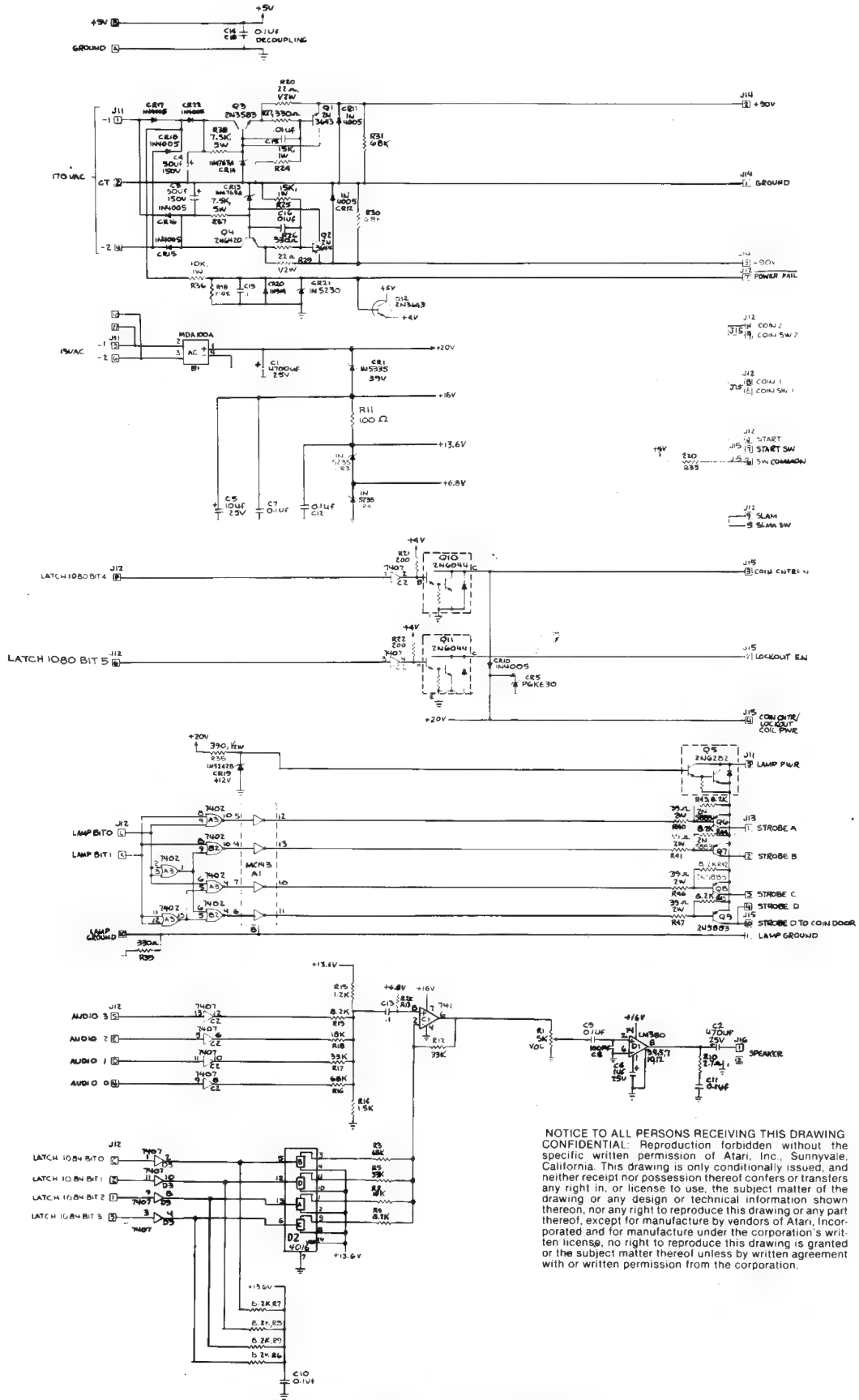


Figure 4-8 Auxiliary PCB Schematic

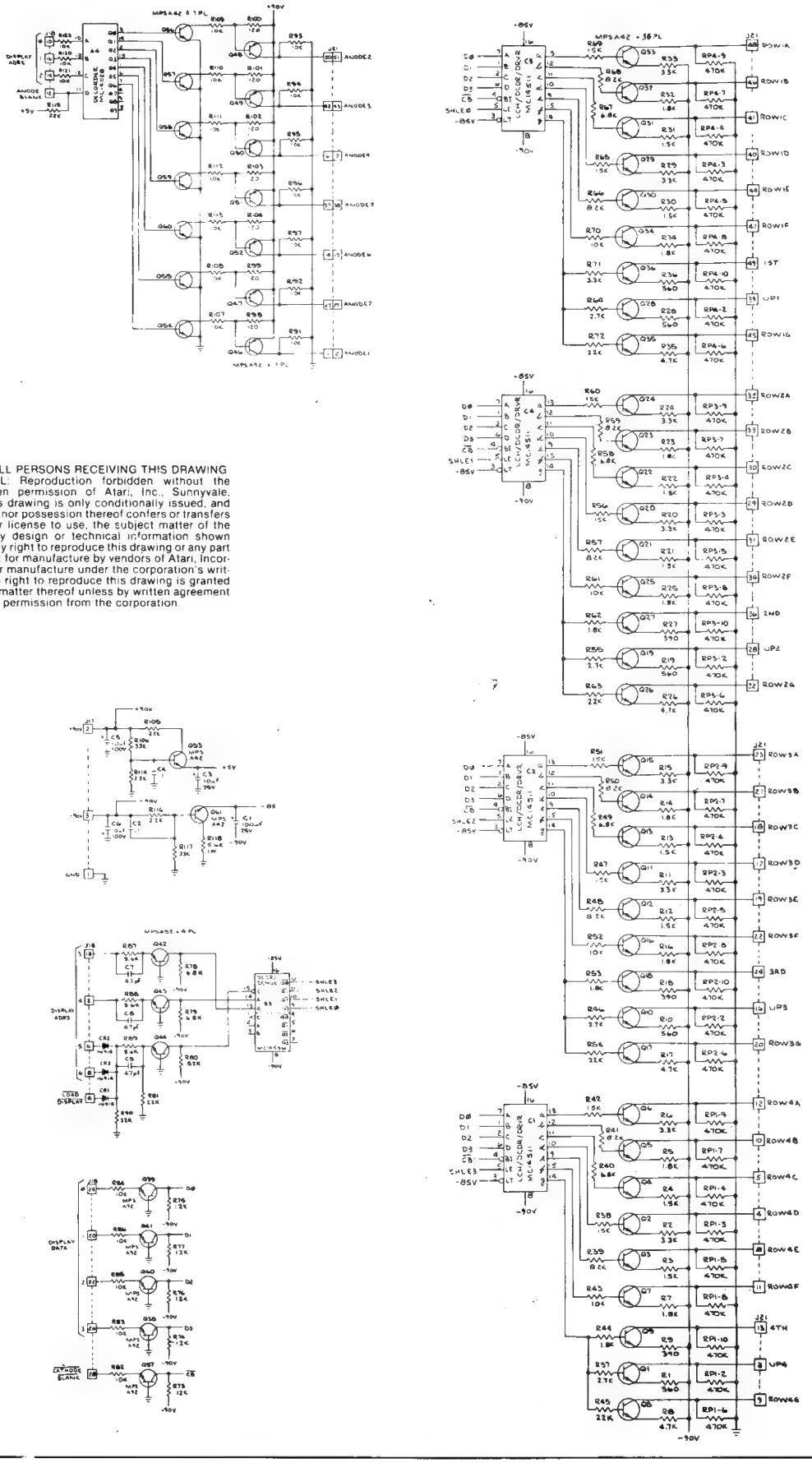


Figure 4-9 Score Display PCB Schematic

D. MATCH/CREDIT PCB – See schematic, Figure 4-10

The Match/Credit PCB also receives its update information from the Processor PCB. LOAD DISPLAY reflects the timing of the MPU's DMA routine, and indicates when the actual loading of Match/Credit display information should take place. If DISPLAY ADDRESS 5 is high and DISPLAY ADDRESS 6 is low, this indicates to the Match/Credit PCB that the display information contained on DISPLAY DATA 0 through 3 is intended for updating the Match/Credit display. DISPLALY ADDRESS 0, 1, and 2 are decoded to determine which of the four digits on the Match/Credit display is being updated. DISPLAY DATA 0 through 3 contain the actual MPU RAM information with which the appropriate digit is updated. CATHODE BLANK and ANODE BLANK inhibit, or blank, the Match/Credit display while it is being updated.

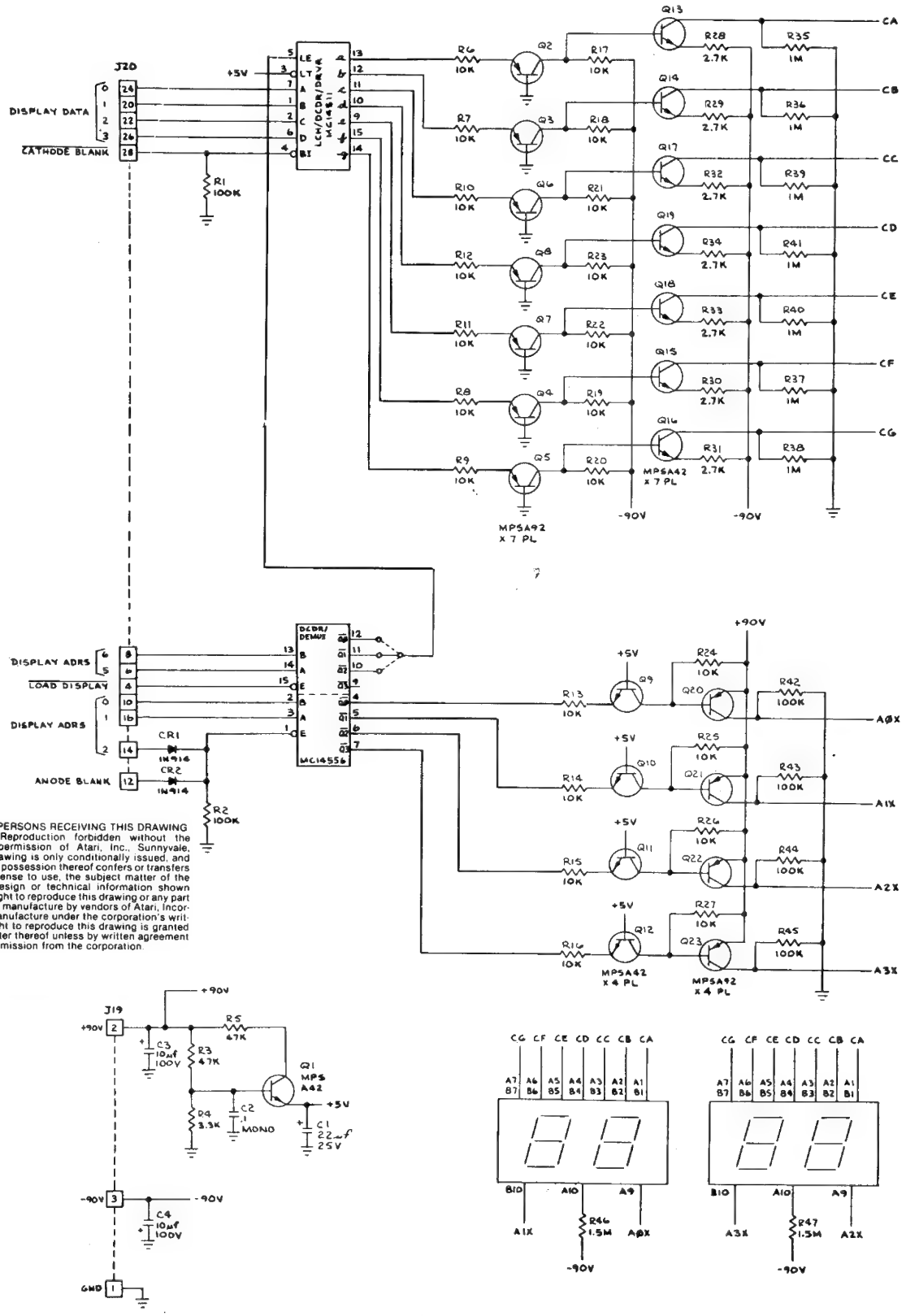
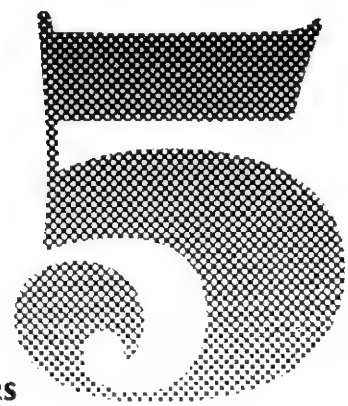


Figure 4-10 Match/Credit PCB Schematic

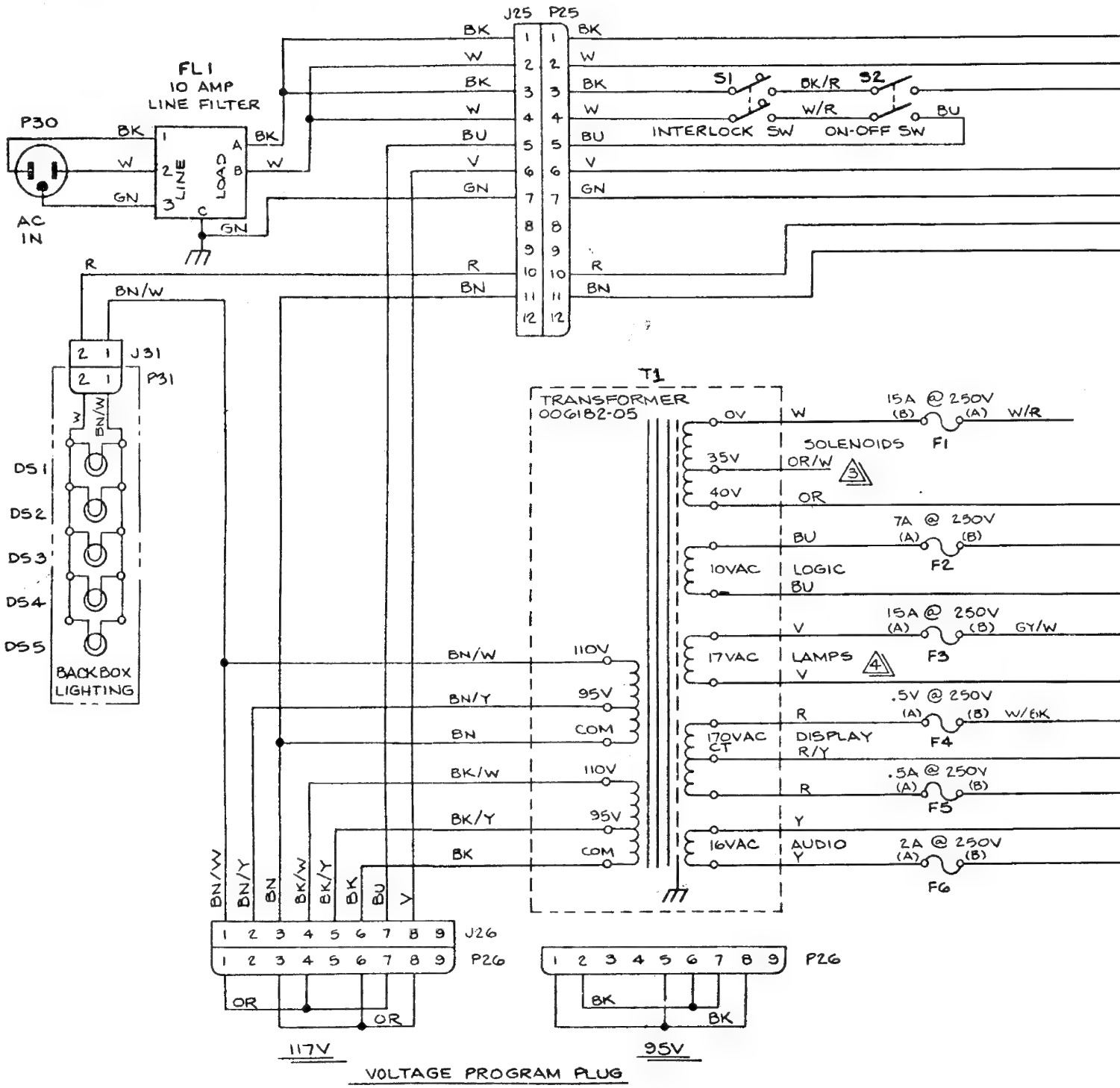
TROUBLESHOOTING

The most effective aid for troubleshooting an Atari pinball game is the Self-Test Procedure. This procedure will allow you to locate stuck switches, burned-out lamps, broken harness wires, burned-out solenoids, and bad printed circuit boards. It is all possible if you use Self-Test to your advantage.



A. POWER DISTRIBUTON – See Power Supply Schematic, Figure 5-1A and 5-1B

At the right rear bottom of the cabinet is the game Power Supply. It makes no difference whether you have a 115 V or 220 V game, the output of Power Supply is always the same. The Power Supply provides six voltages: SOLENOIDS, LOGIC, LAMPS, DISPLAY, AUDJO, and Back Box lighting.



3 OPTIONAL 35VAC FOR SOLENOID DRIVE. OPTIONAL WIRE COLOR GN/Y.

4 OPTIONAL WIRE COLOR GREEN.

5 FOR MACHINE WITH OPTIONS, GREEN WIRE IN CONNECTOR P21 PIN 7 IS DISCONNECTED & GREEN WIRE PROVIDED WITH OPTIONAL METER BOARD KIT ASSY FROM P33 PIN 2 IS CONNECTED TO P21 PIN 7.

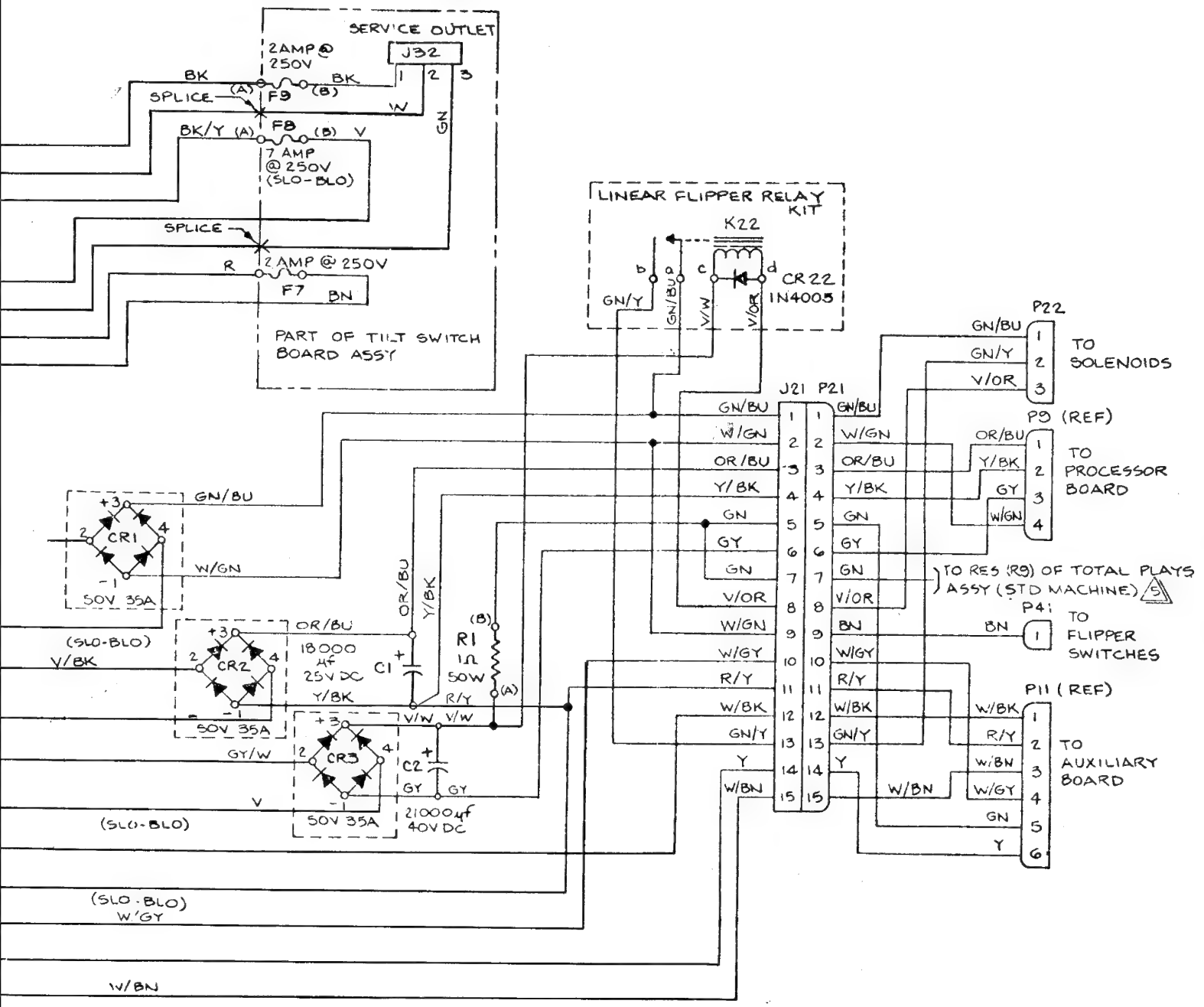
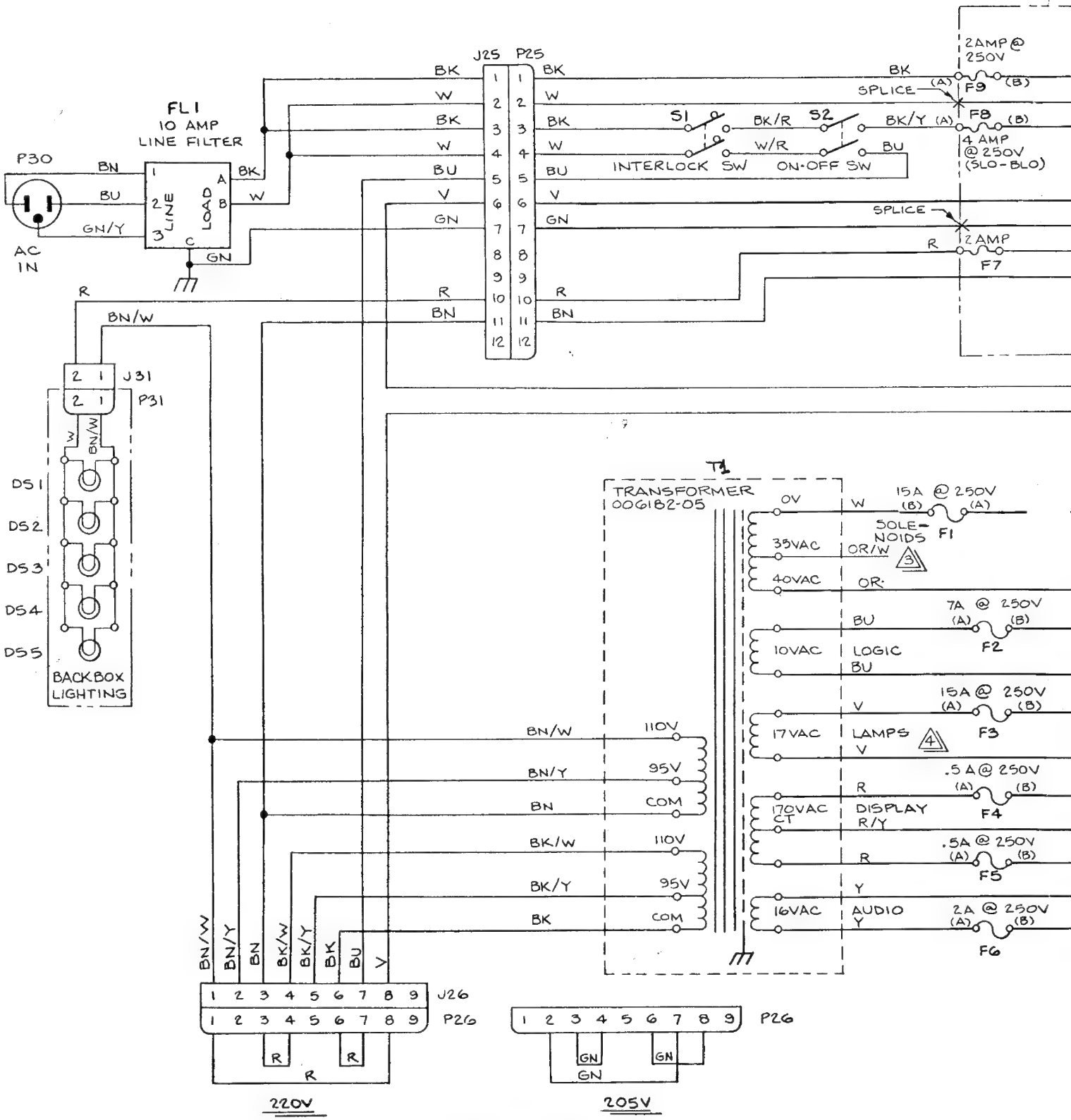


Figure 5-1A Schematic of Power Supply for 95/117 V Operation


FL1
10 AMP
LINE FILTER
P30
AC IN
LINE
LOAD
J25 P25
INTERLOCK SW
ON-OFF SW
S1
S2
SPLICE
2AMP @ 250V
4 AMP @ 250V (SLO-BLO)
F9
F8
F7
J31
P31
DS1
DS2
DS3
DS4
DS5
BACKBOX LIGHTING
T1
TRANSFORMER 00618Z-05
0V
35VAC
40VAC
10VAC
17VAC
170VAC CT
16VAC
SOLE-NOIDS
LOGIC
LAMPS
DISPLAY R/Y
AUDIO
15A @ 250V
7A @ 250V
.5A @ 250V
2A @ 250V
F1
F2
F3
F4
F5
F6
110V
95V
COM
J26
P26
220V
205V
VOLTAGE PROGRAM PLUG

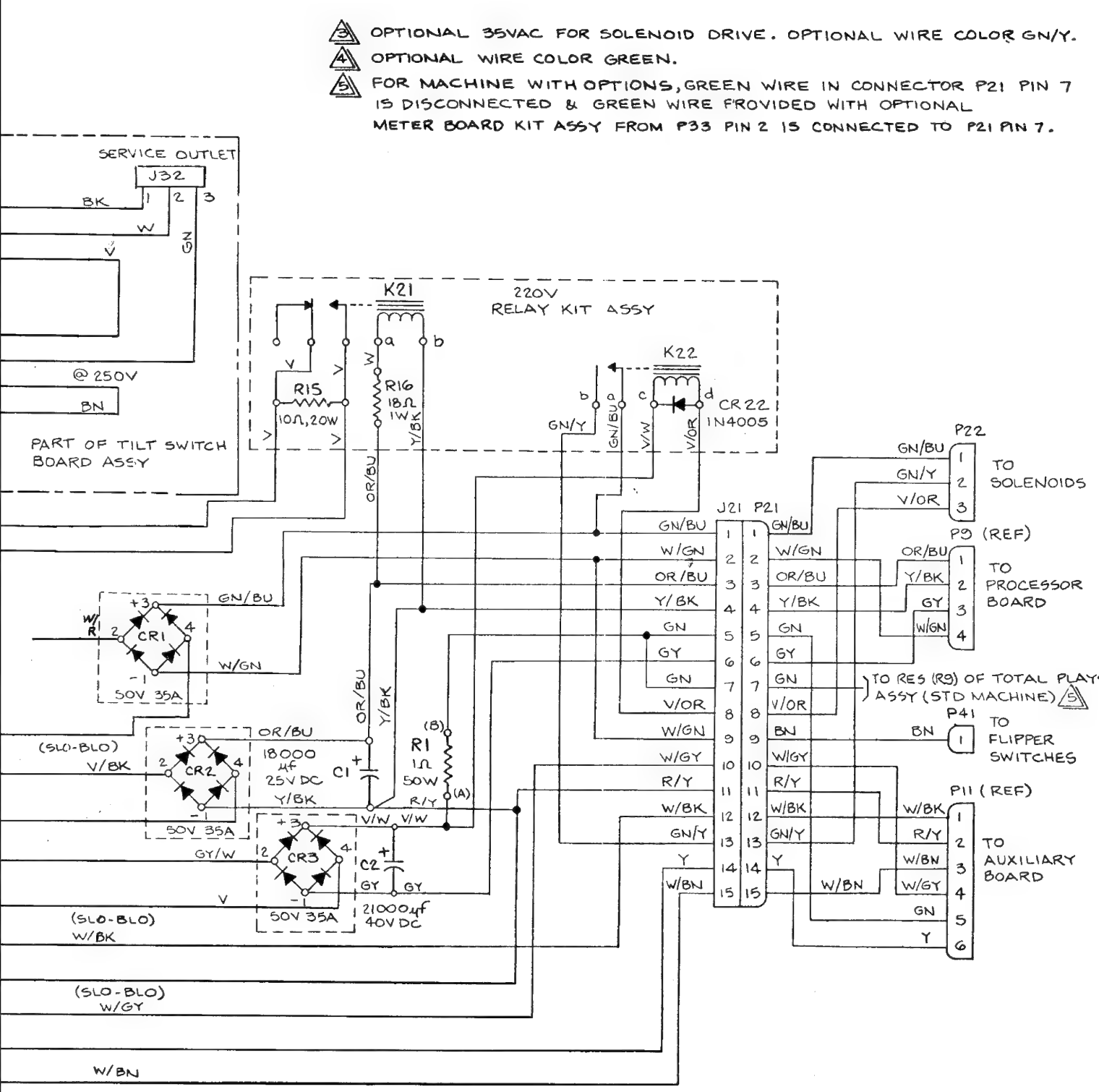


Figure 5-1B Schematic of Power Supply for 205/220 V Operation

1. Solenoid Power

The Solenoids, except the flippers, are directly connected to +40 VDC through connector J21. The ground side of each of these solenoids is connected to the Solenoid Driver's J8 connector of the Processor PCB. A Fuse Board on the J8 connector of this PCB protects the Solenoid Drivers from a possible shorted harness wire or shorted solenoid coil.

The flippers receive their power only when Flipper Relay K22 is energized. The relay is energized by Flipper Control Solenoid Driver Q12 on the Processor PCB. Once Flipper Relay K22 is energized, +40 VDC is applied to the flipper solenoids. The ground side of the flipper solenoids is connected directly to ground, through the flipper switches.

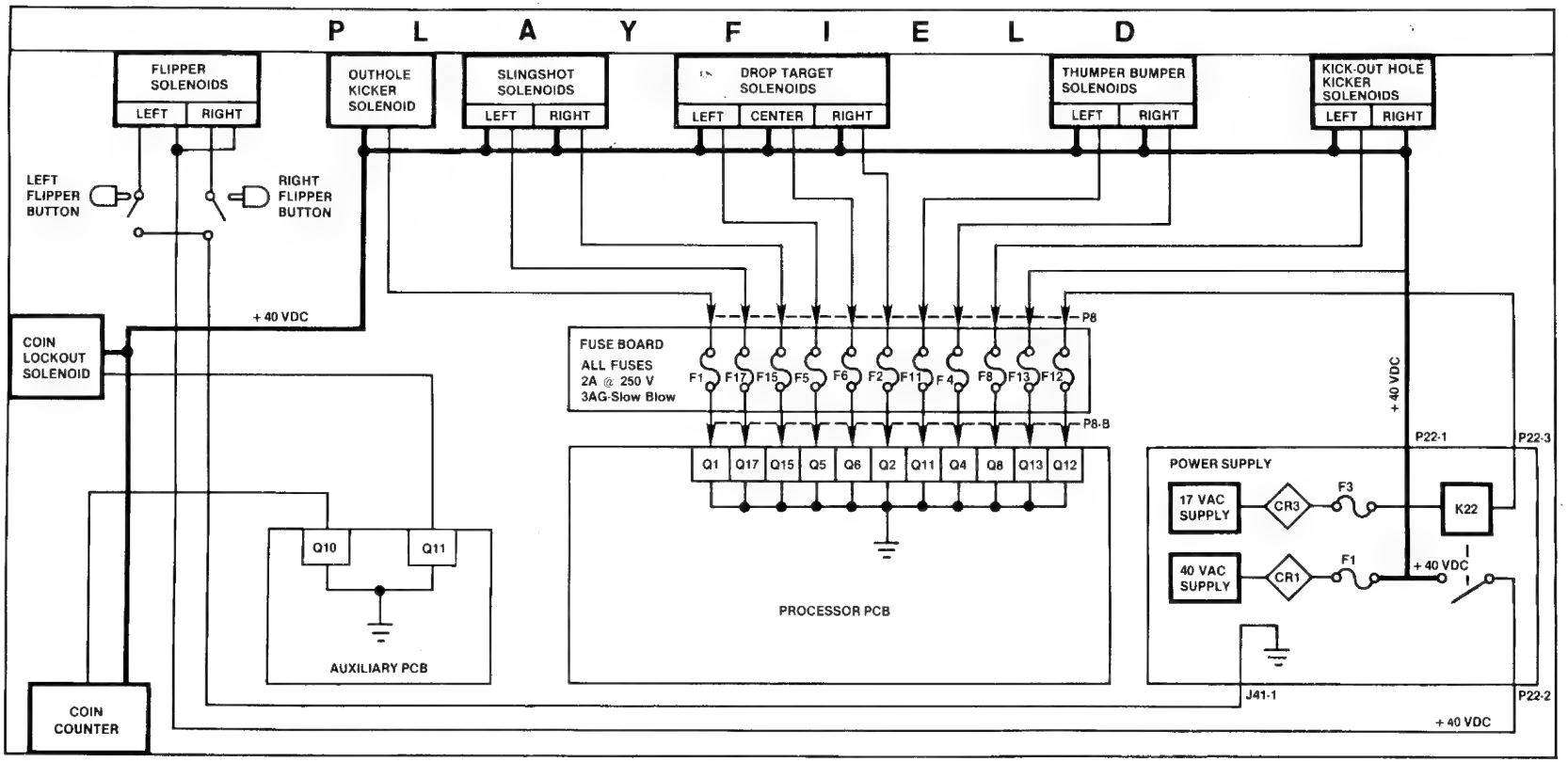


Figure 5-2 Solenoid Operational Block Diagram

2. Logic Power

Logic power comes from the Power Supply as +10 VDC and goes to the Processor PCB. Power Regulator LM323 reduces this voltage to +5 VDC. The +5 VDC voltage powers all integrated circuits on the Processor PCB and most of the integrated circuits on the Auxiliary PCB.

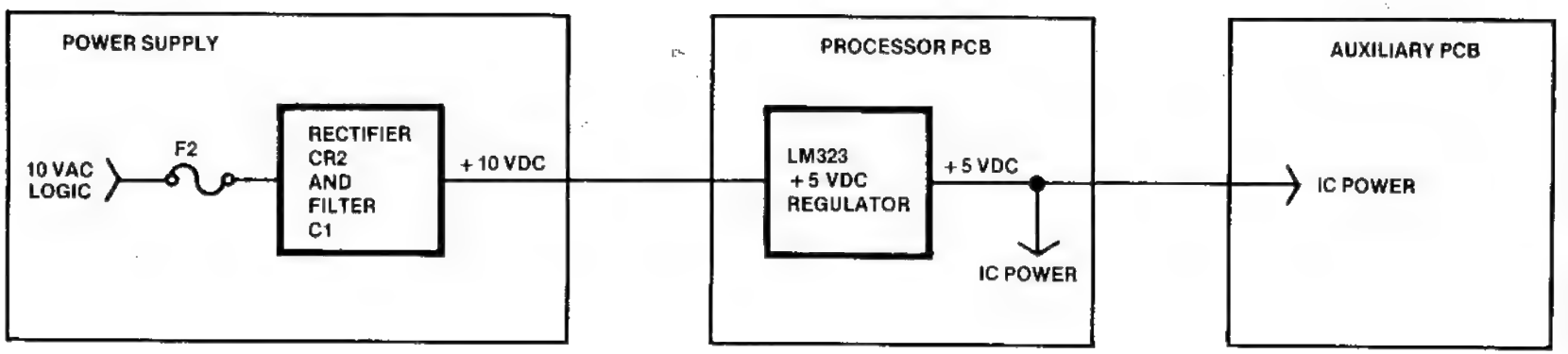


Figure 5-3 Logic Power Block Diagram

3. Lamp Power

The playfield lamps all receive their actual lighting current from the 17 VAC LAMPS winding of the transformer T1 on the Power Supply. However, the 16 VAC AUDIO, from the Power Supply, powers the bias voltage on the base of Lamp Power transistor Q5 on Auxiliary PCB. Transistor Q5 controls all current to Strobe transistors Q6 thru Q9. These transistors are enabled by LAMP BITS from the Processor PCB. Each Strobe output of the Auxiliary PCB is applied to many Playfield and Coin Door lamps. The ground side of each lamp (as many as twelve playfield illumination lamps are paralleled on one strobe output) is grounded through the Processor PCB Lamp Drivers.

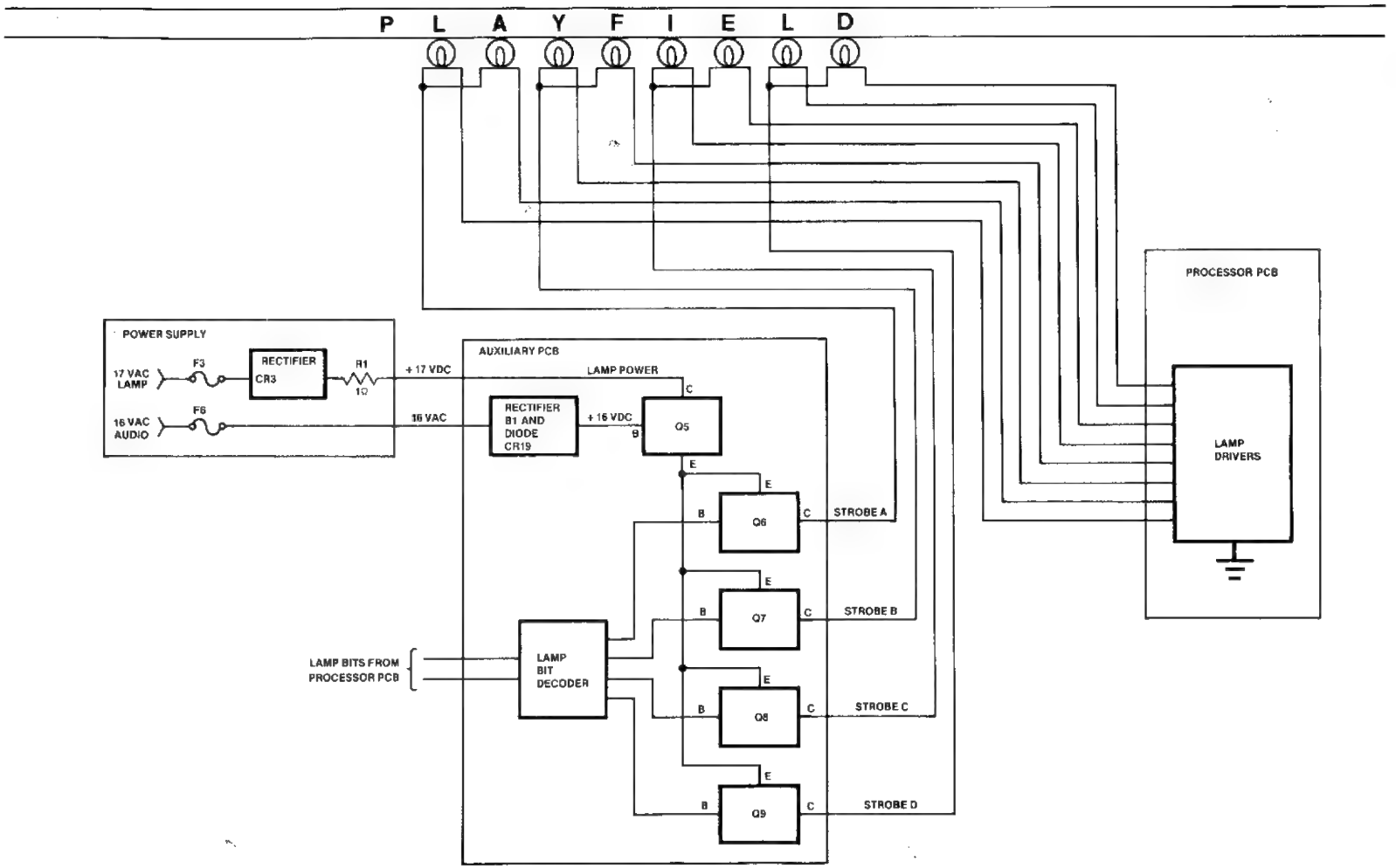


Figure 5-4 Lamp Power Block Diagram

4. Display Power

The Display Power is from the 170 VAC winding of the transformer on the Power Supply. This voltage is received by the Auxiliary PCB, full wave rectified, the + and −90 VDC is fed to both the Score and Match/Credit Displays. Use CAUTION when working with this voltage, as it can generate enough electrical shock to knock you on your buns.

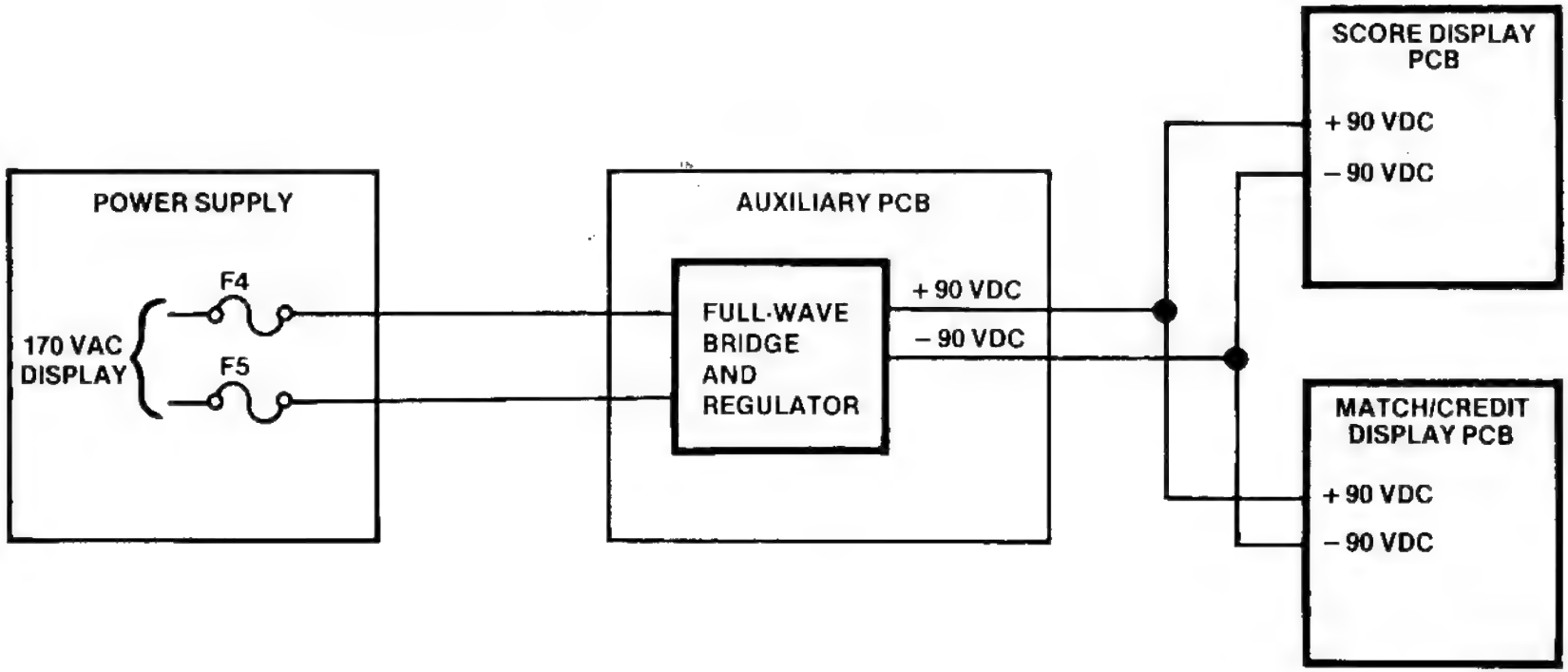


Figure 5-5 Display Power Block Diagram

5. Audio Power

The Audio Power is from the transformer s16 VAC winding on the Power Supply. This voltage is received by the Auxililary PCB, rectified and divided down into four different voltages. Three of these voltages are used in the Audio Circuit. The fourth voltage, 20 VDC, is used in the Lamp Circuit.

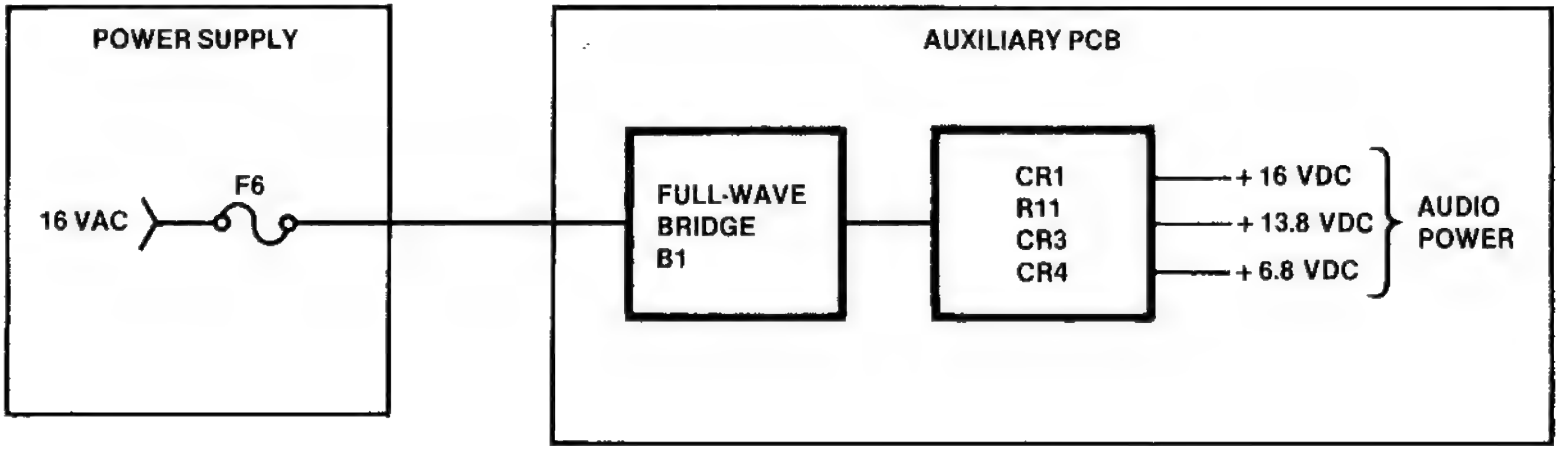


Figure 5-6 Audio Power Block Diagram

B. SWITCHES

The Space Riders playfield has only three micro-switches. These are used on the three Drop Targets. All other switches are open-leaf switches.

There are four possible causes of a failing switch: 1) The switch may be out of adjustment and therefore never close or always be closed. 2) Edge connector P7, to the Processor PCB may not receive closed switch information. 3) A harness wire may be pinched or broken. 4) The Processor PCB may be defective.

The best method for troubleshooting a failing switch is to set the game into the Switch Test step of the Self-Test mode. Generally, if the Processor PCB is defective, more than one switch will fail. A corroded edge-connector may easily be cleaned, merely by removing the corrosion with a pencil eraser.

C. SOLENOIDS AND SOLENOID FUSES

In order for a solenoid to work, a switch must be closed (except Coin Lock-Out Solenoid). Therefore, always remember that a failing solenoid may be caused by a bad switch or switch wire harness, a bad solenoid or solenoid wire harness or a defective Processor PCB. The best way to isolate the reason for failure is to use the Solenoid Test and Switch Test of the Self-Test procedure.

1. Solenoids

As you can see in Figure 5-2, there are two voltage paths to the solenoids: 1) +40 VDC through Relay K22 to the Flipper Solenoids, and 2) +40 VDC to all other solenoids. All playfield solenoids, except the Flipper Solenoids, are energized (grounded) by the Processor PCB. The Flipper Solenoids are enabled by the Processor PCB through Relay K22, in the Power Supply. The Coin Lock-Out and Coin Counter Solenoids are energized (grounded) by the Auxiliary PCB. (Actual commands to energize these two solenoids are from the Processor PCB.)

2. Solenoid Fuses

The eleven solenoid outputs (connector J8) of the Processor PCB are all protected by a fuse for each output on the Fuse Board. The Fuse Board plugs directly onto connector J8 of the Processor PCB. The Solenoid plug P8 then plugs directly onto the Fuse Board.

NOTE

If you should ever need to replace one of the Solenoid Drivers Q1 thru Q20, always replace the accompanying Driver Diode CR1 thru CR20.

D. LAMPS

All lamps in the Space Riders game are driven by STROBES A thru D from the Auxiliary PCB and grounded through the Processor PCB. One or two failing lamps may be caused by either a bad lamp or a bad lamp harness wire. If a large group of lamps, but not all lamps, fail, the cause may be a defective Lamp Driver on the Processor PCB or a defective Strobe Transistor Q6 thru Q9. If all lamps fail, it may be caused by either a loss of LAMP POWER or AUDIO POWER from the Power Supply, or a defective Auxiliary PCB.

E. TESTING PRINTED CIRCUIT BOARDS

You can test the game PCBs either right in the game, or your distributor may test them on his test bench, if he has a PBS-1 Pinball Simulator. However, the following test and troubleshooting procedure makes the following assumptions: 1) All Power Supply voltages are correct, and 2) all game harness wires and connectors are good. To test the PCBs, follow PCB Test, Table 5-1. If the PCBs fail the test of Table 5-1, troubleshoot the PCBs, following PCB Troubleshooting, Table 5-2.

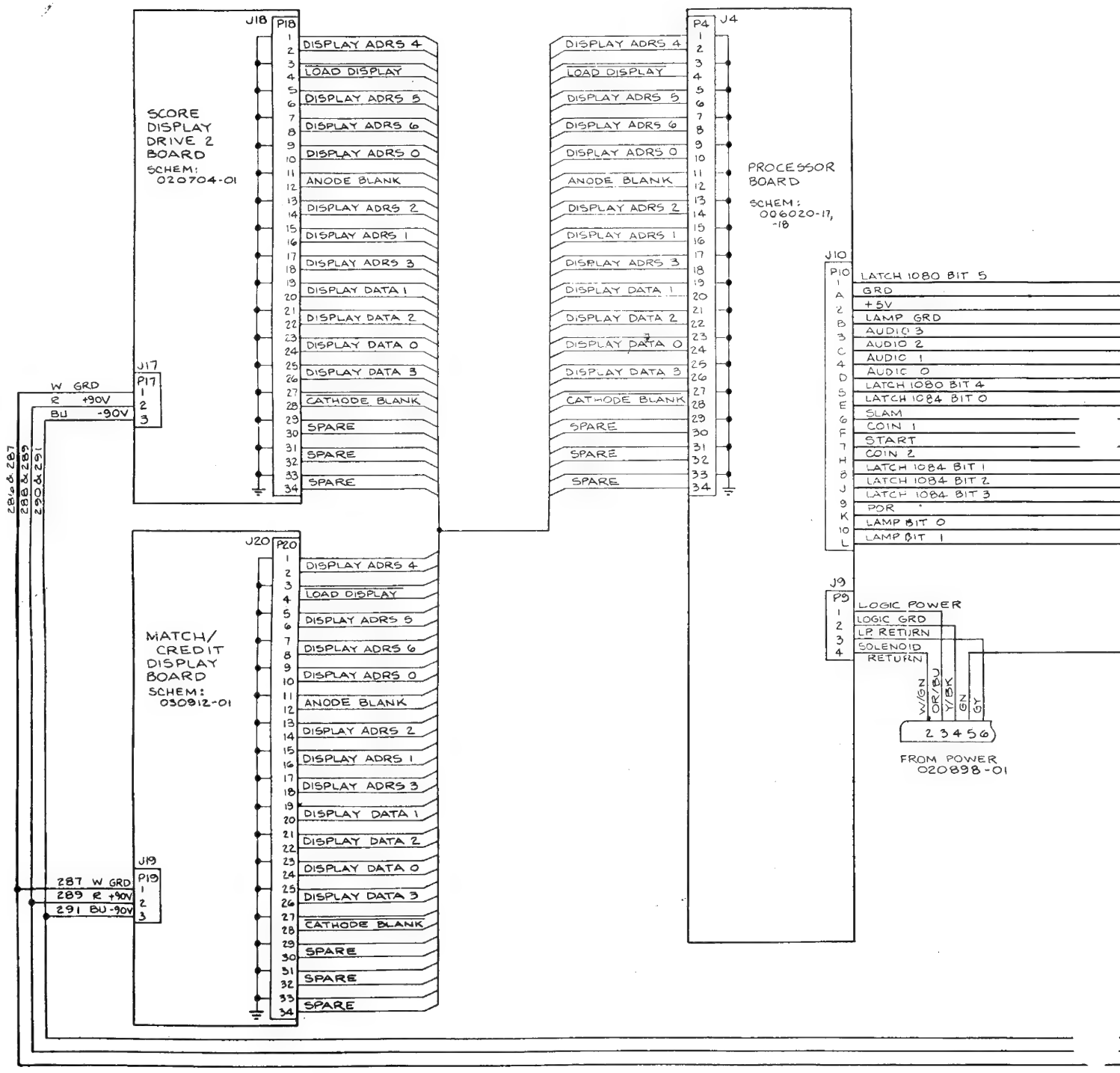
For those of you with an Atari Automatic ROM/RAM Tester, we have included the Space Riders Memory Map, Table 5-6.

F. SPACE RIDERS WIRE HARNESS

Figure 5-7 is the Interconnect and Wiring Diagram for the Space Riders game. Sheet 1 of this drawing illustrates all wire connections for the displays, audio, and coin door. Sheet 2 illustrates the wiring for all playfield lamps, switches, and solenoids, and game metering.

Your game came to you with one of two methods of identifying the wires. Figure 5-7 identifies these both. The first method is a combination of hot-stamped and color-coded wires. The second method is only color-coded wires.

In the first method, all wires to and from solenoids are RED, all wires to and from switches are YELLOW, and all wires to and from lamps are WHITE. Each of



these wires are hot-stamped at the solenoid, switch, or lamp end of the wire with a number, as identified in Figure 5-7. The rest of the wires are color-coded, also identified in Figure 5-7. In the second method, all wires are color-coded, as identified in Figure 5-7.

NOTES

3. THE METER BOARD KIT ASSEMBLY IS AN OPTIONAL REPLACEMENT FOR THE TOTAL PLAYS ASSEMBLY. THE BLUE & GREEN WIRES AS SHOWN BY ---------- REPLACE THE STANDARD BLUE & GREEN WIRES WHEN THE METER BOARD KIT ASSEMBLY IS INSTALLED.
4. WIRES WITH WIRE NUMBERS ADJACENT TO COLOR ARE PART OF THE PLAYFIELD HARNESS. THE COLORS SHOWN ARE FOR COLOR CODED HARNESS ONLY (A020900-01). HOT STAMPED HARNESS (A020900-02) HAS WIRE NO. STAMPED ON WIRE & 3 BASE COLORS CODED AS FOLLOWS: RED = ALL SOLENOIDS & LINEAR FLIPPER SWITCHES S31, S33. YELLOW = ALL OTHER SWITCHES
WHITE = ALL LAMPS & CONNECTOR TO CONNECTOR

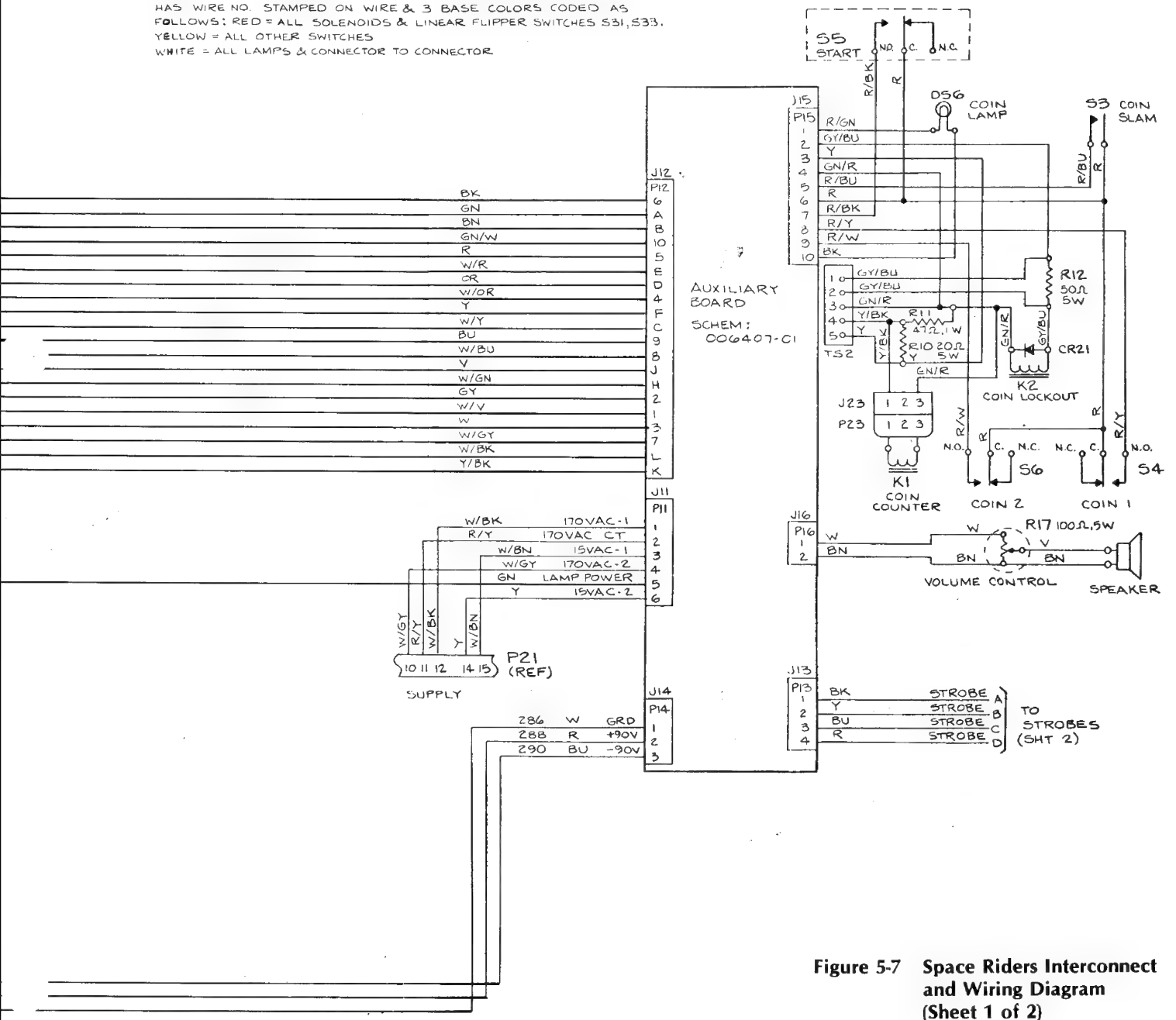
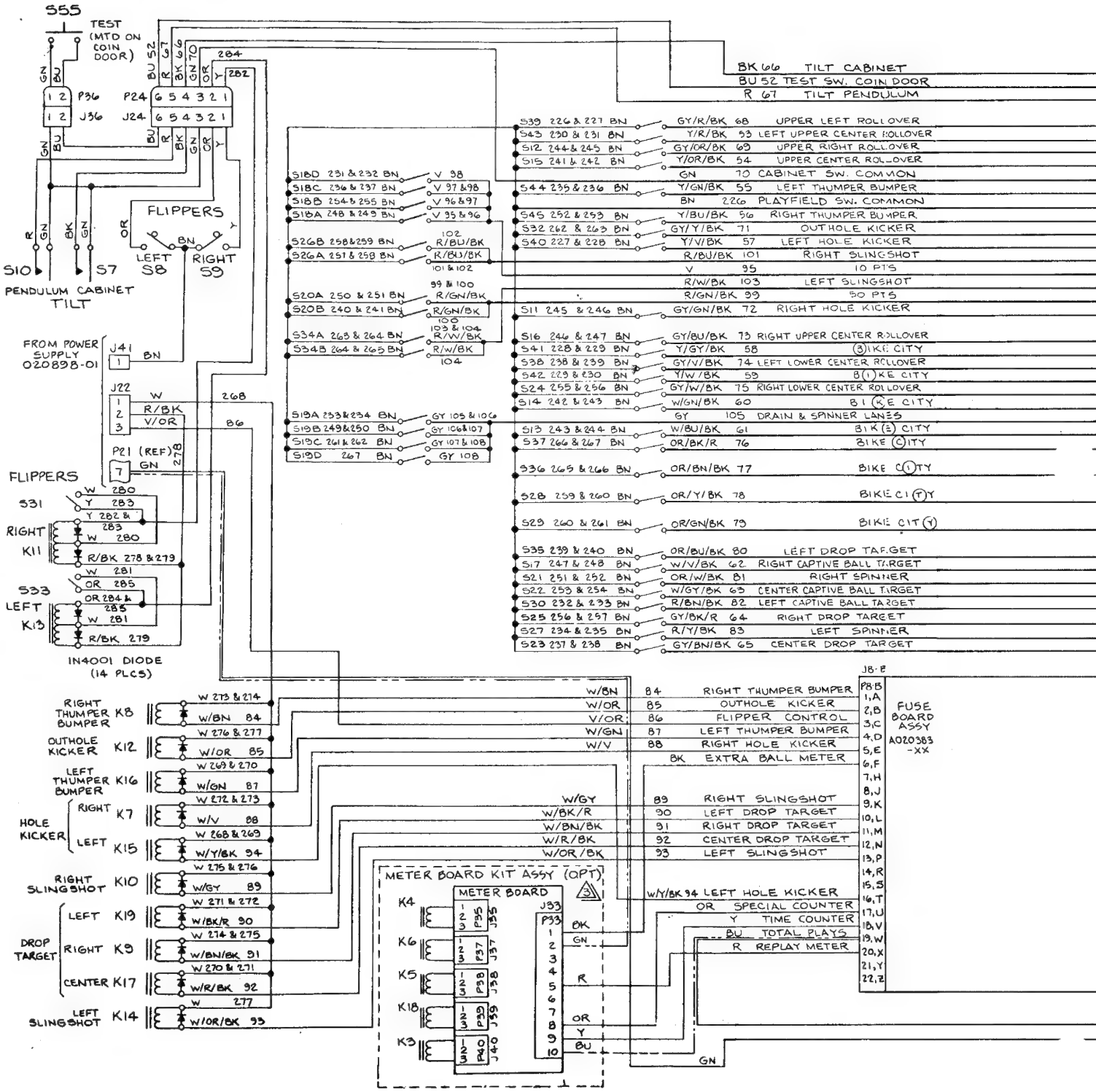


Figure 5-7 Space Riders Interconnect and Wiring Diagram (Sheet 1 of 2)


S55
TEST (MTD ON COIN DOOR)
P36
P24
J36
J24
FLIPPERS
LEFT S8
RIGHT S9
S10
S7
PENDULUM CABINET TILT
FROM POWER SUPPLY 02089B-01
J41
J22
P21 (REF)
FLIPPERS
S31
RIGHT K11
S33
LEFT K13
IN4001 DIODE (14 PLCS)
BK 66 TILT CABINET
BU 52 TEST SW. COIN DOOR
R 67 TILT PENDULUM
S39 226 & 227 BN GY/R/BK 68 UPPER LEFT ROLLOVER
S43 230 & 231 BN Y/R/BK 53 LEFT UPPER CENTER ROLLOVER
S12 244 & 245 BN GY/OR/BK 69 UPPER RIGHT ROLLOVER
S15 241 & 242 BN Y/OR/BK 54 UPPER CENTER ROLLOVER
GN 70 CABINET SW. COMMON
S44 235 & 236 BN Y/GN/BK 55 LEFT THUMPER BUMPER
BN 226 PLAYFIELD SW. COMMON
S45 252 & 253 BN Y/BU/BK 56 RIGHT THUMPER BUMPER
S32 262 & 263 BN GY/Y/BK 71 OUTHOLE KICKER
S40 227 & 228 BN Y/V/BK 57 LEFT HOLE KICKER
R/BU/BK 101 RIGHT SLINGSHOT
V 95 10 PTS
R/W/BK 103 LEFT SLINGSHOT
R/GN/BK 99 50 PTS
S11 245 & 246 BN GY/GN/BK 72 RIGHT HOLE KICKER
S16 246 & 247 BN GY/BU/BK 73 RIGHT UPPER CENTER ROLLOVER
S41 228 & 229 BN Y/GY/BK 58 BIKE CITY
S38 238 & 239 BN GY/V/BK 74 LEFT LOWER CENTER ROLLOVER
S42 229 & 230 BN Y/W/BK 59 BIKE CITY
S24 255 & 256 BN GY/W/BK 75 RIGHT LOWER CENTER ROLLOVER
S14 242 & 243 BN W/GN/BK 60 BIKE CITY
GY 105 DRAIN & SPINNER LANES
S13 243 & 244 BN W/BU/BK 61 BIKE CITY
S37 266 & 267 BN OR/BK/R 76 BIKE CITY
S36 265 & 266 BN OR/BN/BK 77 BIKE CITY
S28 259 & 260 BN OR/Y/BK 78 BIKE CITY
S29 260 & 261 BN OR/GN/BK 79 BIKE CITY
S35 239 & 240 BN OR/BU/BK 80 LEFT DROP TARGET
S17 247 & 248 BN W/V/BK 62 RIGHT CAPTIVE BALL TARGET
S21 251 & 252 BN OR/W/BK 81 RIGHT SPINNER
S22 253 & 254 BN W/GY/BK 63 CENTER CAPTIVE BALL TARGET
S30 232 & 233 BN R/BN/BK 82 LEFT CAPTIVE BALL TARGET
S25 256 & 257 BN GY/BK/R 64 RIGHT DROP TARGET
S27 234 & 235 BN R/Y/BK 83 LEFT SPINNER
S23 237 & 238 BN GY/BN/BK 65 CENTER DROP TARGET
S18D 231 & 232 BN V 98
S18C 236 & 237 BN V 97 & 98
S18B 254 & 255 BN V 96 & 97
S18A 248 & 249 BN V 95 & 96
S26B 258 & 259 BN R/BU/BK 102
S26A 251 & 258 BN R/BU/BK 101 & 102
S20A 250 & 251 BN R/GN/BK 99 & 100
S20B 240 & 241 BN R/GN/BK 100
S34A 263 & 264 BN R/W/BK 103 & 104
S34B 264 & 265 BN R/W/BK 104
S19A 233 & 234 BN GY 105 & 106
S19B 249 & 250 BN GY 106 & 107
S19C 261 & 262 BN GY 107 & 108
S19D 267 BN GY 108
J8-B
FUSE BOARD ASSY A0203B3 -XX
W/BN 84 RIGHT THUMPER BUMPER
W/OR 85 OUTHOLE KICKER
V/OR 86 FLIPPER CONTROL
W/GN 87 LEFT THUMPER BUMPER
W/V 88 RIGHT HOLE KICKER
BK EXTRA BALL METER
W/GY 89 RIGHT SLINGSHOT
W/BK/R 90 LEFT DROP TARGET
W/BN/BK 91 RIGHT DROP TARGET
W/R/BK 92 CENTER DROP TARGET
W/OR/BK 93 LEFT SLINGSHOT
W/Y/BK 94 LEFT HOLE KICKER
OR SPECIAL COUNTER
Y TIME COUNTER
BU TOTAL PLAYS
R REPLAY METER
GN
METER BOARD KIT ASSY (OPT)
METER BOARD
RIGHT THUMPER BUMPER K8
OUTHOLE KICKER K12
LEFT THUMPER BUMPER K16
HOLE KICKER RIGHT K7
HOLE KICKER LEFT K15
RIGHT SLINGSHOT K10
DROP TARGET LEFT K19
DROP TARGET RIGHT K9
DROP TARGET CENTER K17
LEFT SLINGSHOT K14

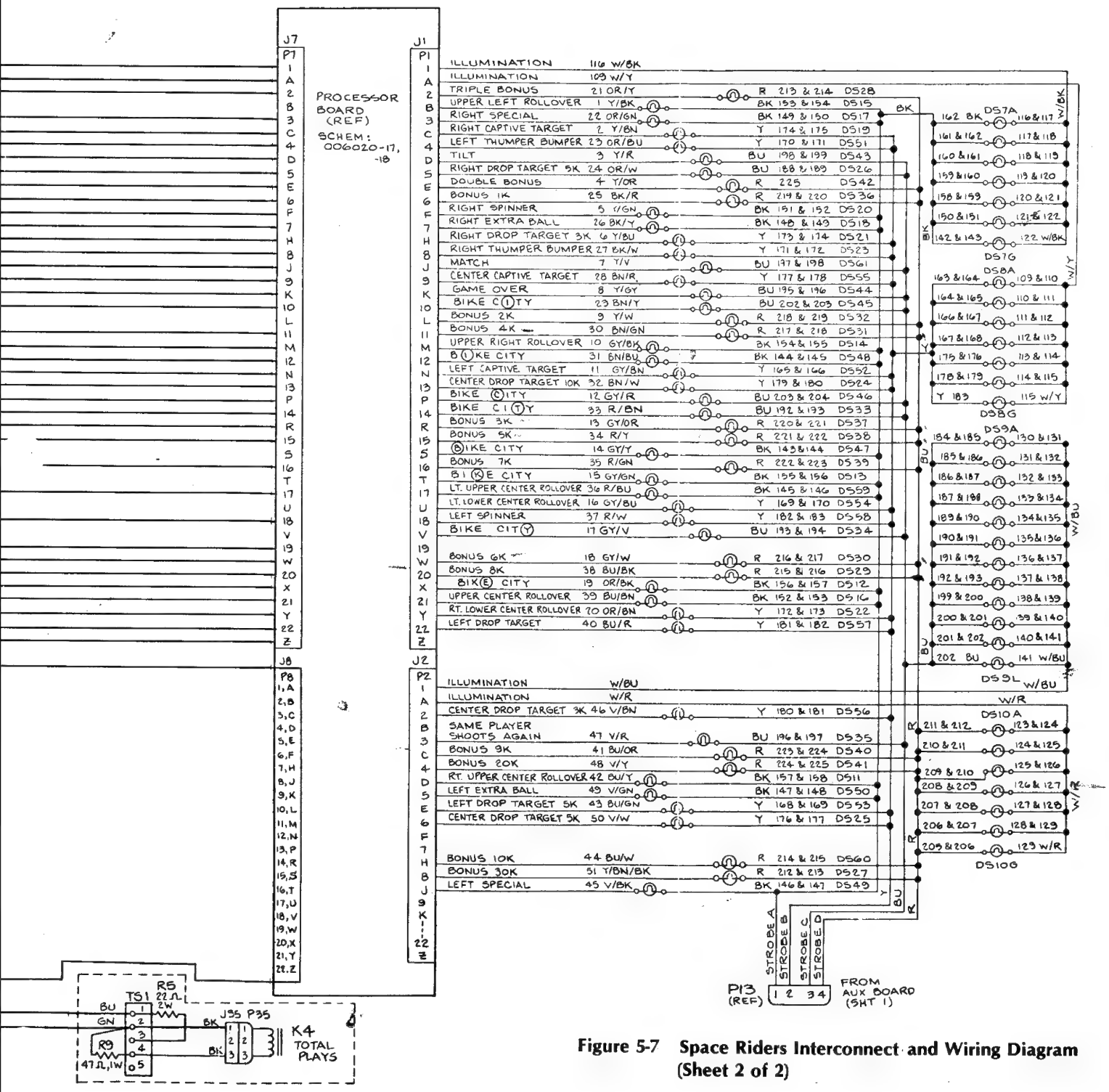


Figure 5-7 Space Riders Interconnect and Wiring Diagram (Sheet 2 of 2)

Table 5-1 PCB Test

Test Instruction	If Test Passes:	If Test Fails:
1 Prepare Space Riders game as follows: a) Remove playfield glass b) Write down settings of PROG SW1, PROG SW2, and REPLAY rotary switch of the Processor PCB c) Set all toggles of PROG SW1 and PROG SW2 to OFF d) Set REPLAY rotary switch to 0 e) Lower Playfield and turn game on.	Score and Match/Credit Displays show all *8's*.	Check if connector J4 of the Processor PCB is firmly seated. If firmly seated, unplug J4 and leave off until completion of Step 3. If Step 3 passes, see Table 5-2, Steps 1 thru 13, Step 1 of Table 5-3, Steps 1 thru 7 of Table 5-4, and/or Steps 1 and 2 of Table 5-5.
2 Are Playfield lamps flashing in the Attract Mode?	See Step 3	See Steps 14 thru 46 of Table 5-2
3 Are Coin Door lamp and all Playfield lamps *on*?	See Step 4	See Steps 2 and 3 of Table 5-3
4 Are all solenoids (Coin Lock-Out Coil should energize) off?	See Step 5	See Steps 47 thru 49 of Table 5-2
5 After about 60 seconds from when game is turned on, does Score and Match/Credit go blank?	See Step 6	See Steps 50 and 51 of Table 5-2
6 Trip both left and right Coin Door Coin Switches...was there an audio response for each tripped switch?	See Step 7	See Steps 52 thru 68 of Table 5-2
7 Press START pushbutton. Was there an audio response?	See Step 8	See Steps 69 and 70 of Table 5-2
8 When Flipper Buttons are pressed, do Flippers flip?	See Step 9	Troubleshoot Processor PCB driver Q12 and associated circuitry.
9 Press and release Coin Door TEST pushbutton — once only. Are all game lamps lighted?	See Step 10	See Steps 58 and 59 of Table 5-2
10 Press Coin Door TEST switch once only. Do Solenoids energize while an identification number is displayed in the Credit Display, as listed in Self-Test Label Procedure in Section 1? (To change from one SOLENOID to the next, press START.)	See Step 11	See Steps 60 thru 62 of Table 5-2
11 Press Coin Door TEST switch once. One at a time Press all Playfield, Cabinet, and Coin Door switches. Is there an audio response and identification number in the Credit Display as listed in Self-Test Procedure in Section 1?	PCBs are all OK.	Troubleshoot Processor PCB Switch Output and Input circuitry.

Table 5-2 Processor PCB Troubleshooting

	Troubleshooting Question	Instruction for YES Answer	Instruction for NO Answer
1	Is there an Attract Mode?	See Step 2	See Step 14
2	Is there any Display?	See Step 3	See Step 11
3	Is $\overline{\text{DMA INT}}$ pulsing?	See Step 4	Troubleshoot Counters A6, A7, and Gate B8 in PHASE 1 and PHASE 2 clocks
4	Is $\overline{\text{CATHODE BLANK}}$ pulsing?	See Step 5	Troubleshoot Gate B2 and Buffer A3
5	Is $\overline{\text{HALT}}$ pulsing?	See Step 6	Troubleshoot Flip-Flop B6, Bate B7, etc., and Gate A2
6	Is ANODE BLANK pulsing?	See Step 7	Troubleshoot Gate B7
7	Is $\overline{\text{LD}}$ pulsing?	See Step 8	Troubleshoot Flip-Flop B6
8	Is $\overline{\text{LOAD DISPLAY}}$ pulsing?	See Step 9	Troubleshoot One-Shot B10, Gate B8, and Buffers A3 and B4
9	Are DISPLAY ADDRS outputs pulsing?	See Step 10	Troubleshoot Counters B3, B4, and Buffers A3, A4, and A5
10	Are DISPLAY DATA outputs pulsing?	Suspect RAM	Troubleshoot multiplexer B5 and Buffers A5, or suspect bad RAM
11	Are Display segments missing?	Troubleshoot multiplexer B5, Buffers A5 or suspect bad RAM	See Step 12
12	Are Display rows missing?	See Step 13	Troubleshoot Counter B3
13	Are B4 outputs pulsing?	Troubleshoot Buffers A4	Troubleshoot Counter B4
14	Is Program Memory same Part Numbers as listed in Chapter 7, Illustrated Parts Catalog?	See Step 15	Replace Program Memory with proper ROMs
15	Is +5V Supply, from LM323 Regulator, +5VDC and no ripple?	See Step 16	Troubleshoot LM323 circuit
16	Are PHASE 1 and PHASE 2 pulsing?	See Step 17	Troubleshoot Clock Circuit
17	Is $\overline{\text{RESET}}$ high?	See Step 20	See Step 18
18	Is A2, pin 8 low?	See Step 19	Troubleshoot Buffers A4 and B11
19	Clip and lift C9, pin 5. Is Attract Mode still failing?	See Step 20	Troubleshoot Counters A9 and A10 and gates F1
20	Is C1, pin 4 high?	See Step 21	Troubleshoot IRQ pullup resistor R33
21	Is $\overline{\text{HALT}}$ low or pulsing?	See Step 22	See Step 23
22	Is $\overline{\text{DMA INT}}$ pulsing?	Troubleshoot Flip-Flop B6 and gates A2 and B7.	Troubleshoot Counters A6, A7, and A8
23	Check all address lines to ensure they are not shorted to one another, to ground, to +5VDC, or open... are all address lines OK?	See Step 24	Correct and restart PCB Test, Table 5-1
24	Check all data lines to ensure they are not shorted to one another, to ground, to +5VDC, or open... are all address lines OK?	See Step 25	Correct and restart PCB Test, Table 5-1
25	Turn game OFF. Replace Program Memory. Turn game to ON... is game in Attract Mode?	Restart PCB Test, Table 5-1	See Step 26
26	Set game to OFF. Replace MPU, C1. Set game to ON... is game in Attract Mode?	Restart PCB Test, Table 5-1	See Step 27
27	Ground A4, pin 7. Is C1, pin 40 low?	See Step 28	Troubleshoot Buffers A4 and B11 and Gate A2

Table 5-2 Processor PCB Troubleshooting

	Troubleshooting Question	Instruction for YES Answer	Instruction for NO Answer
28	Are all address lines high, except A0 low?	See Step 31	See Step 29
29	Are address lines A6 thru A11 high?	See Step 30	Troubleshoot address lines A6 thru A11 for shorts to other traces
30	Is $\overline{BA}$ high?	Troubleshoot Tri-State Buffers C4 and C5	Troubleshoot buffer D4
31	Are all data lines in tri-state?	If Program Memory is in locations E1 thru E8, see Step 35. If Program Memory is in locations E0 and E00, See Step 39	See Step 32
32	Are data lines D1 thru D5 tri-state?	See Step 33	Troubleshoot data lines D1 through D5 for shorts to other traces.
33	Is $\overline{\text{SWITCH READ}}$ high?	Troubleshoot Tri-State Buffer C5	See Step 34
34	Is C6, pin 11 high?	Troubleshoot Gate C8	Troubleshoot Decoder C6
35	Are pins 10 of E1 thru E8 high?	See Step 37	See Step 36
36	Is C6, pin 5 high?	Troubleshoot gate C8	Troubleshoot Decoder D6
37	Is Pin 8 of E1 thru E8 low?	See Step 44	See Step 38
38	Is D1, pin 15 low?	Troubleshoot Decoder D1	Troubleshoot Buffer B11
39	Are pins 20 of E0 and E00 high?	See Step 44	See Step 40
40	Is F1, pin 2 high?	See Step 42	See Step 41
41	Is C6, pin 5 high?	Troubleshoot gate C8	Troubleshoot Decoder C6
42	Is D1, pin 9 low?	Troubleshoot gates F0 and F1	See Step 43
43	Is D1, pin 15 low?	Troubleshoot Decoder D1	Troubleshoot Decoder D1
44	Are D6 and D7, pins 10 high?	See Step 46	See Step 45
45	Is D1, pin 1 high?	Troubleshoot Decoder D1 and Gate B2	Troubleshoot Decoder D1
46	Are D5 and D8, pins 10 high?	Troubleshoot Gate D3	Troubleshoot Decoder D1
47	Is output of the Solenoid Buffer low?	Replace Solenoid Driver Transistor and Diode	See Step 48
48	Is input of the Solenoid Buffer low?	Replace Solenoid Buffer	See Step 49
49	Set game power to OFF. Clip lead of Solenoid Latch Bit. Set game power to ON... is Solenoid Latch Bit low?	Check for bad Latch Bit trace	Replace bad Latch
50	Is A11, pin 9 pulsing?	See Step 51	Replace A11
51	Is B11, pin 12 pulsing?	Replace Program Memory. Restart PCB Test, Table 5-1	Replace chip B11
52	Does Credit Display show credit increase when either Coin Door Coin Switch is tripped?	See Step 58	See Step 53
53	When either Coin Door Coin Switch is tripped, is C9, pin 12 pulsing?	See Step 56	See Step 54
54	Is E9, pin 8 constantly pulsing?	See Step 55	Troubleshoot Decoders E11 and F6 and Buffers E10
55	When either Coin Door Coin Switch is tripped, is D9, pin 9 high?	Troubleshoot Gate D9	Troubleshoot Buffers D11 and E9
56	Is C5, pin 15 constantly pulsing?	Troubleshoot Tri-State Buffer C5. (trigger oscilloscope with falling edge of $\overline{\text{SWITCH READ}}$. D7 output of C5 should pulse high during $\overline{\text{SWITCH READ}}$ period.)	See Step 57

Table 5-2 Processor PCB Troubleshooting

	Troubleshooting Question	Instruction for YES Answer	Instruction for NO Answer
57	Is C6, pin 11 constantly pulsing?	Troubleshoot Gate C8	Troubleshoot Decoder C6.
58	Is there audio response to tripped Coin Door Coin Switch?	See Step 64	See Step 59
59	Is RAM chip D12 present and plugged correctly into socket?	See Step 60	Correct and restart PCB Test, Table 5-1
60	Does D12, pin 3 pulse when either Coin Door Coin Switch is tripped?	Replace ROM D12	See Step 61
61	Does E12, pin 2 constantly pulse?	See Step 62	Troubleshoot Gate C7 and Decoder C6
62	Does E12, pin 14 pulse when either Coin Door Coin Switch is tripped?	See Step 63	Troubleshoot Gate C7 and Decoder C6
63	Does E12, pin 12 pulse once when either Coin Door Coin Switch is tripped?	Troubleshoot Counter D13 inputs and outputs	Troubleshoot Counter E12
64	Is there audio when right Coin Door Coin Switch (facing front of Coin Door) is tripped?	See Step 67	See Step 65
65	Is D9, pin 9 high when right Coin Door Coin Switch is tripped?	See Step 66	Troubleshoot Buffers D11 and E9
66	Is E9, pin 8 constantly pulsing?	Troubleshoot Gate D9	Troubleshoot Buffer E9 and Decoder F6
67	Is D9, pin 4 high when left Coin Door Coin Switch is tripped?	See Step 68	Troubleshoot Buffers D11 and E9
68	Is E9, pin 2 constantly pulsing?	Troubleshoot Gate D9	Troubleshoot Buffer E9 and Decoder F6
69	Is D9, pin 2 pulsing?	See Step 70	Check Source of 74175 Switch Decoder for possible fault
70	Does logic level at D9, pin 1 change when START button is pressed?	Replace D9	Troubleshoot START input circuit (D11 and E9)
71	Is Lamp Driver 2003A Latch input high?	See Step 72	Troubleshoot appropriate 9334 Latch
72	Is Lamp Driver Latch input low?	Check traces to connector J1 and J2	Replace 2003A Lamp Driver
73	Does base of Solenoid Driver transistor go low?	Replaces Solenoid Driver Transistor and Diode	See Step 74
74	Does output of Solenoid Buffer go low?	Replace Solenoid Driver Transistor and Diode	See Step 75
75	Does output of 9334 Latch go high?	Replace Solenoid Buffer	Troubleshoot 9334 Latch

Table 5-3 Auxiliary PCB Troubleshooting

	Troubleshooting Question	Instruction for YES Answer	Instruction for NO Answer
1	Is ±90VDC Display Power present?	Troubleshoot traces to connector J14	Troubleshoot ±90VDC Regulators
2	Are all lights bad?	Troubleshoot Q5, CR19 and R35	See Step 3
3	Are outputs of A1 pulsing?	Troubleshoot Strobe Transistors Q6 thru Q9	Troubleshoot A1, A3, and B2
4	Is D1, pin 14 +16VDC?	See Step 5	Troubleshoot Rectifier B1 and CR5
5	Is audio information on D1, pin 2?	Troubleshoot amplifier D1 circuit	See Step 6
6	Is audio information present on C1, pins 2 and 3?	Troubleshoot amplifier C1 and volume control circuit	Troubleshoot C2, D2, and D3 circuits.

Table 5-4 Score Display PCB Troubleshooting

1	Are Score Display panel terminals aligned with connector?	See Step 2	Line up terminals
2	Are Score Display panel metal ribbons properly aligned?	See Step 3	Align metal ribbons
3	Are ±90VDC present?	See Step 4	Troubleshoot short
4	Is 5V Regulator +5VDC?	See Step 5	Troubleshoot +5VDC Regulator
5	Are signals LE0 thru LE3 pulsing?	See Step 6	Troubleshoot B3 and input Diode
6	Is output of A4 pulsing?	See Step 7	Troubleshoot A4
7	Is −85V Regulator −85VDC?	Substitute another Score Display Panel (glass) and restart PCB Test, Table 5-1	Troubleshoot −85V Regulator

Table 5-5 Match/Credit PCB Troubleshooting

1	Are outputs of MC14511 all high?	See Step 2	Troubleshoot Q2 thru Q8 and MC14511
2	Are outputs of MC14556 pulsing?	Troubleshoot all Transistor Driver circuits	Troubleshoot MC14556

Table 5-6

Space Riders™ Memory Map
(and instructions for using Automatic ROM/RAM Tester)

PCB PREPARATION FOR ALL TESTS

Remove MPU from PCB under test.
Cut and lift D4 pin 2 and B10 pin 4.

RAM ADDRESS

0000-00FF
Refer to RAM test procedure

ROM ADDRESS

ROM#	PART#	ADDRESS	SOCKET	AUTOMATIC ROM/RAM TESTER SWITCH SETTINGS
PROM 0(E1)	020957	7000 to 73FF	3	Set READ/R/W to center position, STOP/RUN to RUN and 1K/2K to 1K. Test PROMs two at a time as indicated by brackets.
PROM 1(E7)	020961	7000 to 73FF	4	
PROM 2(E2)	020958	7400 to 77FF	3	
PROM 3(E8)	020962	7400 to 77FF	4	
PROM 4(E4)	020959	7800 to 7BFF	3	
PROM 5(E5)	020963	7800 to 7BFF	4	
PROM 6(E3)	020960	7C00 to 7FFF	3	
PROM 7(E6)	020964	7C00 to 7FFF	4	
ROM A(E00)	020965	7000 to 77FF	1	
ROM B(E0)	020966	7800 to 7FFF	1	

SWITCH TEST	HEX ADDRESS	DATA LED
Toggle #1 PROG SW1	(A)200B	D7
Toggle #2 PROG SW1	(A)200A	D7
Toggle #3 PROG SW1	(A)2009	D7
Toggle #4 PROG SW1	(A)2008	D7
Toggle #5 PROG SW1	(A)200F	D7
Toggle #6 PROG SW1	(A)200E	D7
Toggle #7 PROG SW1	(A)200D	D7
Toggle #8 PROG SW1	(A)200C	D7
Toggle #1 PROG SW2	(A)2003	D7
Toggle #2 PROG SW2	(A)2002	D7
Toggle #3 PROG SW2	(A)2001	D7
Toggle #4 PROG SW2	(A)2000	D7
Toggle #5 PROG SW2	(A)2007	D7
Toggle #6 PROG SW2	(A)2006	D7
Toggle #7 PROG SW2	(A)2005	D7
Toggle #8 PROG SW2	(A)2004	D7
SLAM	(A)2013	D7
START	(A)2012	D7
COIN 2	(A)2011	D7

Table 5-6 (cont.)

SWITCH TEST	HEX ADDRESS	DATA LED
COIN 1	(A)2010	D7
TILT (pendulum)	(A)2021	D7
TILT (cabinet)	(A)2020	D7
TOP LEFT ROLLOVER	(A)2022	D7
TOP RIGHT ROLLOVER	(A)2023	D7
UPPER LEFT ROLLOVER	(A)2024	D7
UPPER CENTER ROLLOVER	(A)2025	D7
UPPER RIGHT ROLLOVER	(A)2030	D7
LOWER LEFT ROLLOVER	(A)2031	D7
LOWER RIGHT ROLLOVER	(A)2032	D7
LEFT THUMPER BUMPER	(A)2026	D7
RIGHT THUMPER BUMPER	(A)2027	D7
DRAIN LANES AND SPINNER LANES	(A)2033	D7
B LANE OF *BIKE*	(A)2034	D7
I LANE OF *BIKE*	(A)2035	D7
K LANE OF *BIKE*	(A)2036	D7
E LANE OF *BIKE*	(A)2037	D7
OUTHOLE KICKER	(A)2038	D7
RIGHT SLINGSHOT	(A)2039	D7
LEFT SLINGSHOT	(A)203A	D7
RIGHT HOLE KICKER	(A)203B	D7
LEFT HOLE KICKER	(A)203C	D7
10-POINT SWITCHES	(A)203D	D7
50-POINT SWITCHES	(A)203F	D7
LEFT CAPTIVE BALL TARGET	(A)2040	D7
CENTER CAPTIVE BALL TARGET	(A)2041	D7
RIGHT CAPTIVE BALL TARGET	(A)2043	D7
RIGHT SPINNER	(A)2042	D7
LEFT SPINNER	(A)2046	D7
LEFT DROP TARGET	(A)2044	D7
CENTER DROP TARGET	(A)2045	D7
RIGHT DROP TARGET	(A)2047	D7
C LANE OF *CITY*	(A)2048	D7
I LANE OF *CITY*	(A)2049	D7
T LANE OF *CITY*	(A)204A	D7
Y LANE OF *CITY*	(A)204B	D7

PREPARATION FOR LATCH TEST

Solder B10 pin 4 back down on PCB.
Also, lift A1 pin 1.

LATCH TEST (SOLENOIDS)	HEX ADDRESS	DATA SWITCHES
LEFT THUMPER BUMPER	(A)1084	D5
RIGHT THUMPER BUMPER	(A)1080	D7
LEFT SLINGSHOT	(A)108C	D4
RIGHT SLINGSHOT	(A)108C	D5
OUTHOLE KICKER	(A)1084	D7
LEFT DROP TARGET	(A)108C	D6
CENTER DROP TARGET	(A)1088	D7
RIGHT DROP TARGET	(A)108C	D7
LEFT HOLE KICKER	(A)1084	D4

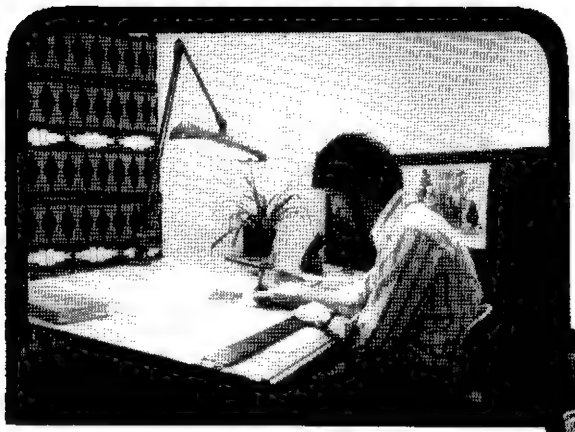
Table 5-6 (cont.)

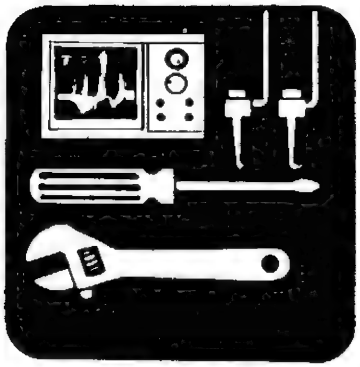
LATCH TEST (SOLENOIDS)	HEX ADDRESS	DATA SWITCHES
RIGHT HOLE KICKER	(A)1080	D6
FLIPPER CONTROL RELAY	(A)1088	D6
EXTRA BALL METER	(A)1084	D6
REPLAY METER	(A)108C	D0
TOTAL PLAYS	(A)108C	D1
SPECIAL COUNTER	(A)108C	D2
TIME COUNTER	(A)108C	D3
LOCKOUT COIL	(A)1080	D5
COIN COUNTER	(A)1080	D4
LATCH TEST (LAMPS)	**HEX ADDRESS**	**DATA SWITCHES**
TOP LEFT ROLLOVER	(A)1000	D0
RIGHT CAPTIVE BALL TARGET	(A)1000	D0
TILT	(A)1000	D0
DOUBLE BONUS	(A)1000	D0
RIGHT SPINNER	(A)1004	D0
3000 POINTS FOR RIGHT DROP TARGET	(A)1004	D0
MATCH	(A)1004	D0
TRIPLE BONUS	(A)1004	D0
SPECIAL FOR RIGHT HOLE KICKER	(A)1008	D0
LEFT THUMPER BUMPER	(A)1008	D0
5000 POINTS FOR RIGHT DROP TARGET	(A)1008	D0
1000 POINTS BONUS	(A)1008	D0
EXTRA BALL FOR RIGHT HOLE KICKER	(A)100C	D0
RIGHT THUMPER BUMPER	(A)100C	D0
GAME OVER	(A)100C	D0
2000 POINTS BONUS	(A)100C	D0
UPPER RIGHT ROLLOVER	(A)1000	D1
LEFT CAPTIVE BALL TARGET	(A)1000	D1
3000 POINTS BONUS	(A)1000	D1
CENTER CAPTIVE BALL TARGET	(A)1004	D1
4000 POINTS BONUS	(A)1004	D1
10,000 POINTS FOR CENTER DROP TARGET	(A)1008	D1
5000 POINTS BONUS	(A)1008	D1
UPPER LEFT ROLLOVER	(A)100C	D1
6000 POINTS BONUS	(A)100C	D1
UPPER RIGHT ROLLOVER	(A)1000	D2
7000 POINTS BONUS	(A)1000	D2
UPPER LEFT ROLLOVER	(A)1004	D2
LEFT SPINNER	(A)1004	D2
8000 POINTS BONUS	(A)1004	D2
UPPER CENTER ROLLOVER	(A)1008	D2
3000 POINTS FOR LEFT DROP TARGET	(A)1008	D2
9000 POINTS BONUS	(A)1008	D2
UPPER RIGHT ROLLOVER	(A)100C	D2
5000 POINTS FOR LEFT DROP TARGET	(A)100C	D2
10,000 POINTS BONUS	(A)100C	D2
SPECIAL FOR LEFT HOLE KICKER	(A)1000	D3
3000 POINTS FOR CENTER DROP TARGET	(A)1000	D3
SAME PERSON SHOOTS AGAIN	(A)1000	D3
20,000 POINTS BONUS	(A)1000	D3
EXTRA BALL FOR LEFT HOLE KICKER	(A)1004	D3
5000 POINTS FOR CENTER DROP TARGET	(A)1004	D3
BALL	(A)1004	D3
30,000 POINTS BONUS	(A)1004	D3

TO END TESTING

Solder D4 pin 2 and A1 pin 1 down on PCB.

Replace MPU in socket.





NOTE

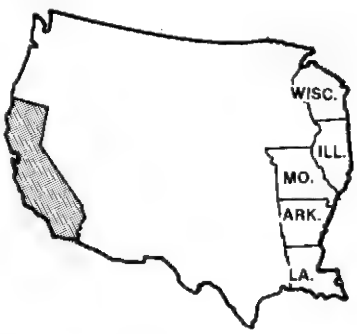
If reading through this manual does not lead to solving a specific maintenance problem, you can call Tele-Help™ at the following two Atari Customer Service offices.

WEST and CENTRAL U.S.A.

Atari Coin Op Customer Service
1344 Bordeaux Drive, Sunnyvale, CA 94086
Telex 17-1103
(Monday - Friday, 7:30 - 4:00 pm Pacific Time)

From California, Alaska, or Hawaii, dial (408) 745-2900

From anywhere else in this area, dial toll free (800) 538-1611



EAST U.S.A.

Atari Inc.
New Jersey Customer Service Office
46 Colonial Drive, Piscataway, NJ 08854
Telex 37-9347
(Monday - Friday, 8:30 - 5:00 pm Eastern time)

From New Jersey dial (201) 981-0490

From anywhere else in this area, dial toll-free (800) 631-5374

MAINTENANCE AND ADJUSTMENTS

A. CLEANING

Game Cabinet Exterior

The exterior parts of the game cabinet and glass may be cleaned with any non-abrasive household cleaner. If desired, special coin machine cleaners which leave no residue can be obtained from distributors.

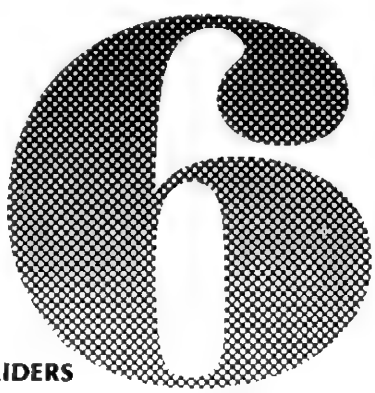
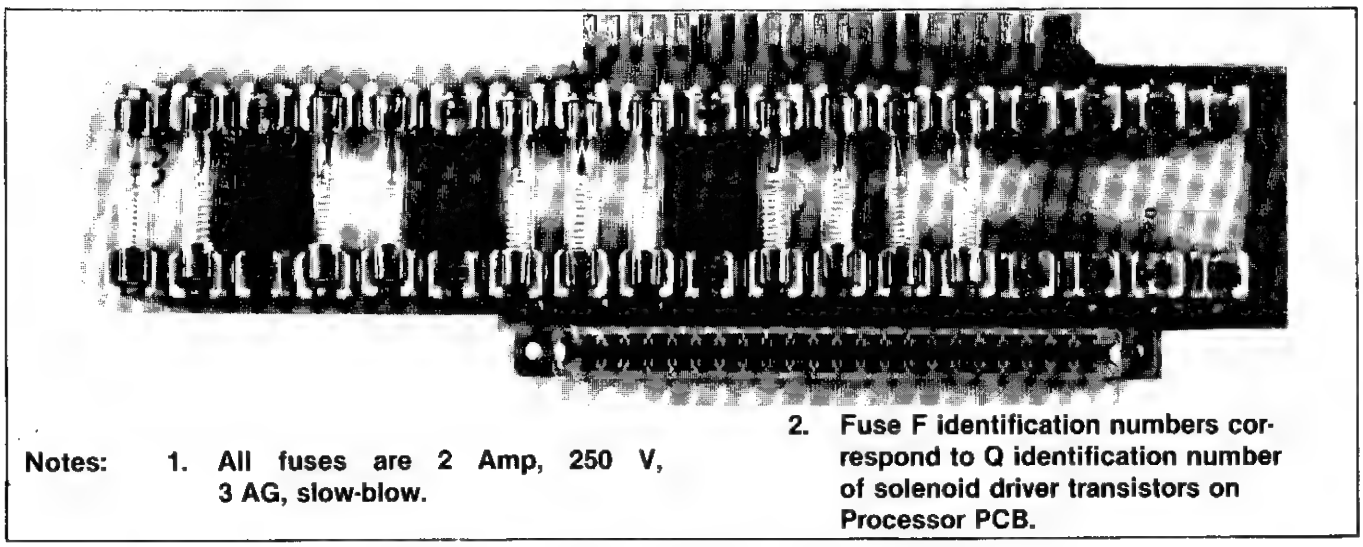


Table 6-1 Fuses Located Near Ball Shooter

Position on Strip	Designation	Circuit Protected	Domestic Fuse Rating	Foreign Fuse Rating
Uppermost fuse	F7	Back Box	2 amps, 250 volts, fast-blow (3AG)	2 amps, 250 volts, fast-blow (3AG)
Middle fuse	F8	Line Power	7 amps, 250 volts, slow-blow (3AG)	4 amps, 250 volts, slow-blow (3AB)
Bottom fuse	F9	Service Outlet	2 amps, 250 volts, fast-blow (3AG)	2 amps, 250 volts, fast-blow (3AG)

Table 6-2 Fuses Located on Power Supply Assembly

Position on Strip	Designation	Circuit Protected	Rating
Uppermost fuse	F6	Audio	2 amps, 250 volts, fast-blow (3AG)
	F5	Displays	0.5 amps, 250 volts, slow-blow (3AG)
	F4	Displays	0.5 amps, 250 volts, slow-blow (3AG)
	F3	Lamps	15 amps, 250 volts, fast-blow (3AB)
	F2	Logic	7 amps, 250 volts, slow-blow (3AG)
Bottom fuse	F1	Solenoids	15 amps, 250 volts, fast-blow (3AB)



Notes: 1. **All fuses are 2 Amp, 250 V, 3 AG, slow-blow.**

2. **Fuse F identification numbers correspond to Q identification number of solenoid driver transistors on Processor PCB.**

Figure 6-1 Location and Sizes of Solenoid Fuses

Playfield

The surface of the playfield has a finish chosen for its long-wearing property. Check the surface periodically to make sure that it is both clean and free of foreign material. Also, periodically check the ball to make sure that it also is smooth and clean. Immediately replace any ball that is chipped, burred, corroded, or pitted. A defective ball will cause damage to the playfield surface in a very short time.

Much of the player appeal in pinball games depends on smooth ball travel over the entire playfield. To keep the playfield and ball from wearing out prematurely, Atari recommends using only a non-abrasive cleaner.

Do *not* use such products as "Formula 409" or "Windex," kitchen cleansers, soapy cleaning pads or steel wool, waxes or polishes, or great amounts of water. These products may easily scour and damage the silk-screened artwork, and/or cause buildup of gummy residue.

While cleaning the playfield, avoid getting foreign material into the bodies of the star rollovers. You might cover the switch body with a small amount of masking tape when cleaning around the switch body.

See Chapter 7, Illustrated Parts Catalog for replacement sizes of playfield rubbers.

B. FUSE REPLACEMENT

WARNING

As an additional safety measure when replacing fuses, *always* unplug the power cord before opening the cabinet.

CAUTION

When changing fuses make sure that the replacement fuses have the ratings specified by Atari, and that the fuse is being replaced in the *correct* fuse holder.

Replacement fuse values are listed on charts near both the power supply fuse panel and service panel. In case these fuse value charts have been destroyed, refer to Tables 6-2 and 6-3 for the values. See Figure 6-1 for location and values of solenoid fuses.

C. COIN MECHANISM

Components on Coin Door

Figure 6-2 shows the back side of the coin door assembly where the game's two coin mechanisms are mounted. Included is the lock-out coil assembly; the lock-out wires are connected to this assembly but are hidden behind the coin mechs. During the attract mode, the microcomputer energizes the lock-out coil, causing the lock-out wires to retract far enough to allow genuine coins to reach the coin box. During play mode (and also when AC power to the game has been turned off) the lock-out coil is de-energized, causing the lock-out wires to move out far enough to divert coins over to the coin return chute.

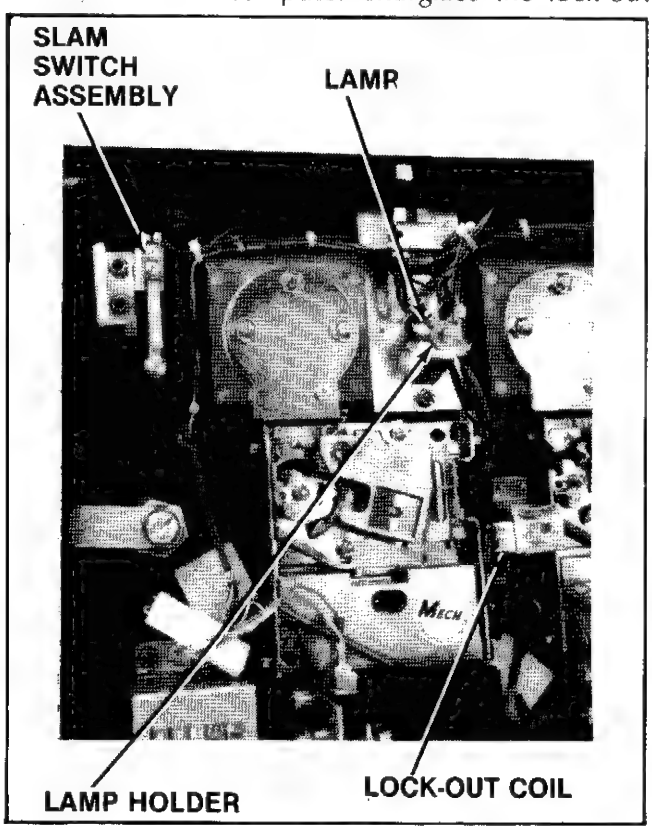


Figure 6-2 Coin Door Assembly

Directly below each coin mechanism is a secondary coin chute and a coin switch with a trip wire extending out to the front edge of the chute. When the trip wire is positioned correctly, a coin passing down the secondary chute and into the coin box will momentarily push the trip wire down and cause the switch contacts to close.

Also shown in the photograph is a slam switch assembly. It has been included to defeat any players who might try to obtain free credits by violently pounding on the coin door to momentarily close the contacts on a coin switch. The slam switch contacts connect to the microcomputer system, which will ignore coin switch signals whenever the slam switch contacts are closed.

Access to Coin Mechanisms

To remove jammed coins, and for maintenance cleaning, each magnet gate assembly can be hinged open without removing it from the door, as shown in Figure 6-3. Or, if necessary, each coin mechanism can

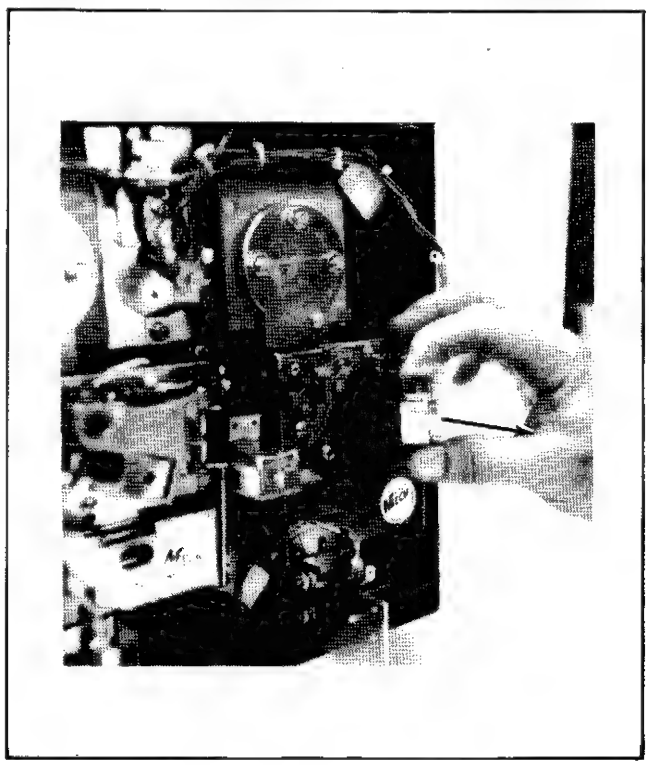


Figure 6-3 Hinging Open the Magnet Gate Assembly

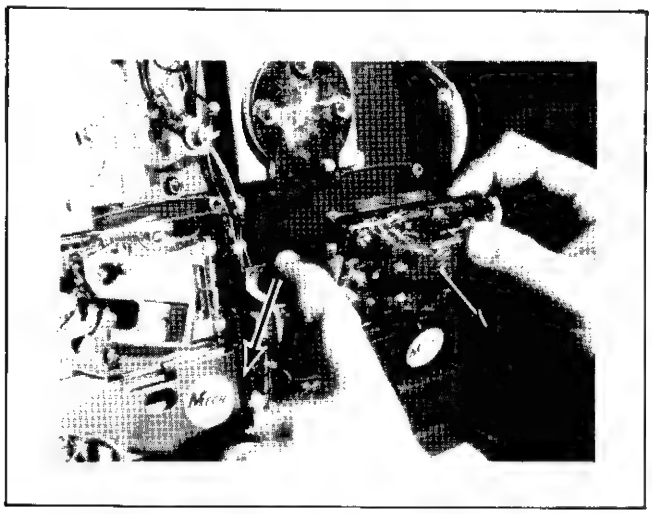
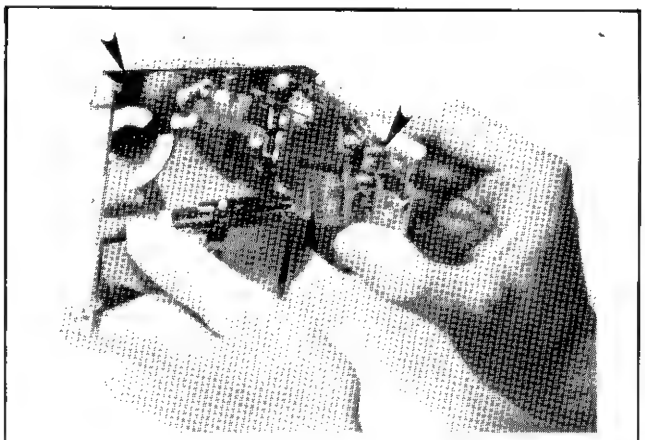


Figure 6-4 Removal of Coin Mechanism



(Clean both surfaces where coin enters the mechanism, as well as the magnet)

Figure 6-5 Surfaces to Clean Inside the Coin Mechanism

be entirely removed from the door merely by pushing down on a release lever and simultaneously tilting the mechanism back, then lifting it up and out. This is shown in Figure 6-4

Cleaning of Coin Paths

CAUTION

The use of an abrasive (such as steel wool or a wire brush) or a lubrication on a coin mechanism will result in a rapid buildup of residue.

By talking to many operators, we have found that the best method of cleaning a coin mechanism is by using hot or boiling water and a milk detergent. A toothbrush may be used for those stubborn buildups of residue. After cleaning, flush thoroughly with hot or boiling water, then blow out all water with compressed air.

Figure 6-5 shows the surfaces to clean inside the coin mechanism. These include the inside surface of the mainplate, and the corresponding surface of the gate assembly. There may also be metal particles clinging to the magnet itself. To remove these you can guide the point of a screwdriver or similar tool along the edge of the magnet.

If coins are not traveling as far as the coin mechanisms, you will need to clean the channel beneath the coin slot. To gain access to this channel, use a ⅜-inch wrench and remove all three nuts that secure the cover plate (refer to Figure 6-6). Removing the plate will provide access to the entire channel.

Also clean the inside surfaces of the secondary coin chutes, but when doing this be careful not to damage or bend the trip wires on the coin switches.

Adjustment of Coin Switch Trip Wire

In order for a coin switch to operate reliably when a coin travels down the secondary coin chute, the rest position of the switch's trip wire should be as shown in Figure 6-7. Use extreme care when handling or touching these wires.

In Figure 6-7 you will note that the coin switch trip wire is oriented into the "V" of the secondary coin chute. The wire should extend to only about 1/8" beyond the chute.

A retaining clip holds the wire onto the switch actuating stud. If you should lose a retaining clip, all is not lost. Just crimp the switch actuating stud over the trip wire with a pair of pliers.

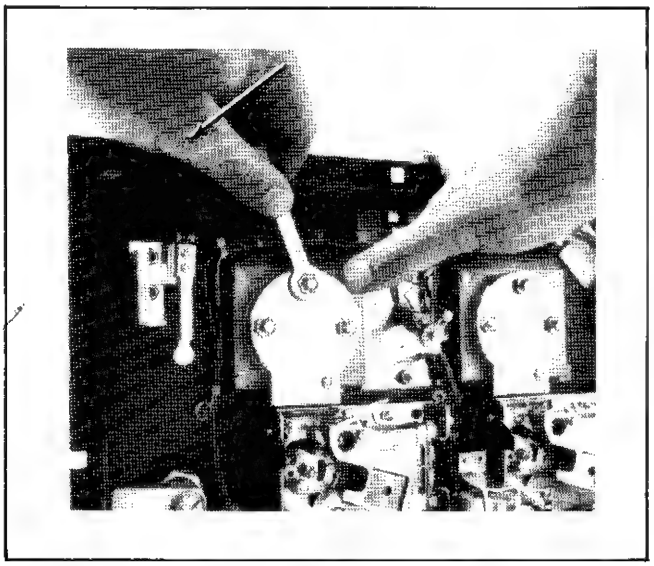


Figure 6-6 Removal of Plate Covering Rear of Coin Slot

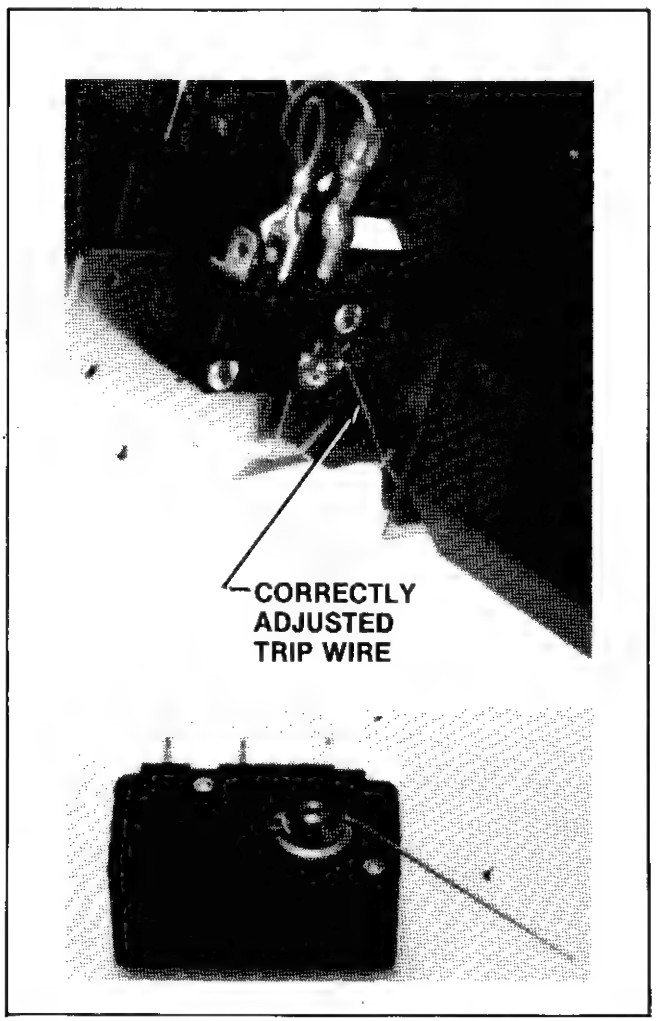


Figure 6-7 Detail View of Coin Switch and Trip Wire

Mechanical Adjustments on Coin Mechanism

Coin mechanisms are adjusted prior to shipment from the factory and normally will retain these adjustments for many months. If, due to wear or other causes, it becomes necessary to make new adjustments, remove the coin mechanism from the coin door. Then take it to a clean well-lighted area where it can be placed in a vertical position on a level surface (such as a bench top). Besides a screwdriver, you will need a set of several coins, including both new and old, worn ones. Figure 6-8 shows an exploded view of the mechanism and gives procedures for adjusting the kicker, separator, and the magnet gate. These adjustments should only be done by someone who has experienced in servicing coin mechanisms and who understands their operation.

Lubrication

Do *not* apply lubrication to the coin mechanisms. The only points that may need lubrication (and only rarely) are the shafts of the scavenger buttons (coin rejection buttons) where they pass through the coin door. Apply only one drop of light machine oil, and be positive that no oil drops down onto a coin mechanism. Figure 6-9 shows this lubrication point.

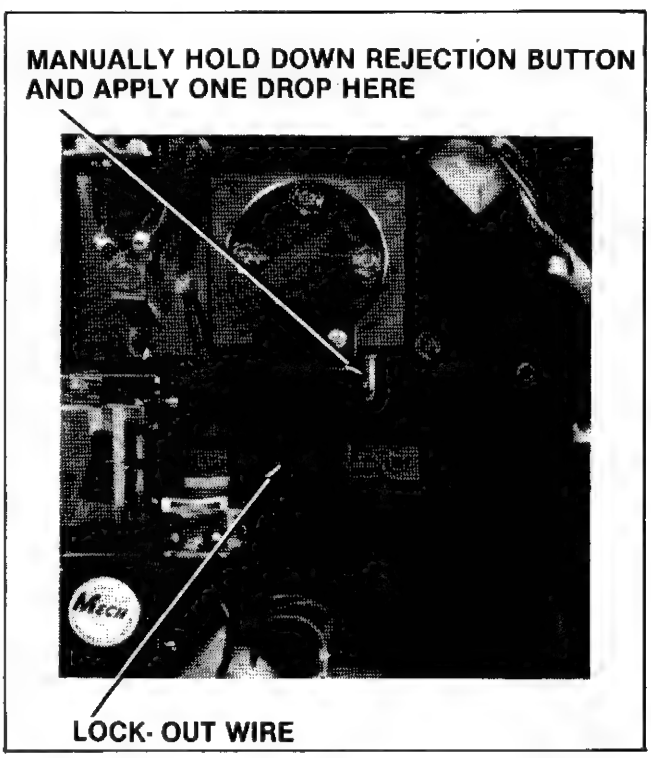
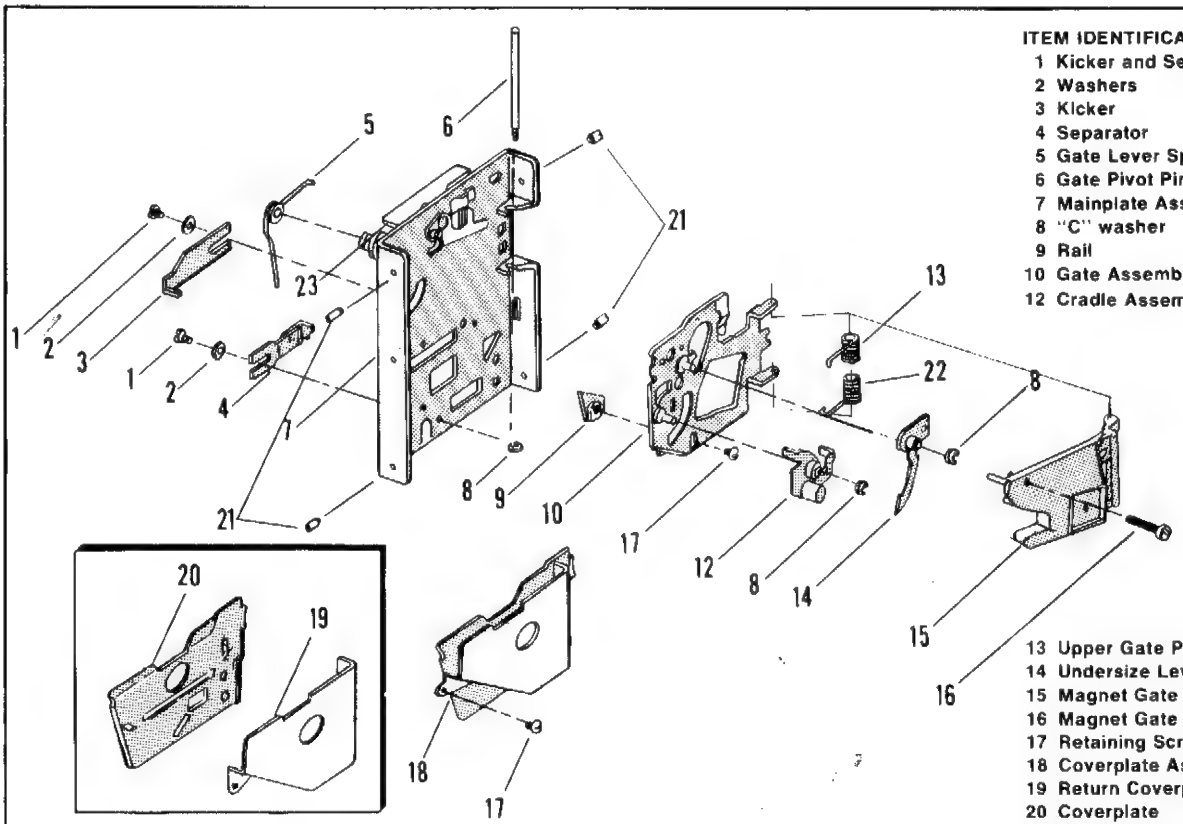


Figure 6-9 Close-up View of Lubrication Point



Kicker and separator

1. Set the acceptor with the back of the unit facing you in the test position.
2. Loosen the kicker and separator screws (1) and move the kicker (3) and the separator (4) as far to the right as they will go. Lightly tighten the screws.
3. Insert several test coins (both old and new) and note that some are returned by striking the separator.
4. Loosen the separator screw and move the separator a slight amount to the left. Lightly retighten the screw.
5. Insert the test coins again and, if some are still returned, repeat Step 4 until all the coins are accepted.
6. Loosen the kicker screw and move the kicker as far to the left as it will go. Lightly retighten the screw.
7. Insert the test coins and note that some are returned.
8. Loosen the kicker screw and move the kicker a slight amount to the right. Lightly retighten the screw.
9. Insert the test coins again and, if some are still returned, repeat Step 8 until all the coins are accepted.
10. Be sure that both screws are tight after the adjustments have been made.

Magnet gate

1. Set the acceptor with the front of the unit facing you in the test position.
2. Turn the magnet gate adjusting screw (16) out or counterclockwise until none of the coins will fit through.
3. With a coin resting in the acceptor entrance, turn the adjuster in or clockwise until the coin barely passes through the magnet gate.
4. Test this adjustment using several other coins (both old and new) and, if any fail to pass through the magnet gate, repeat Step 3 until all the coins are accepted.
5. Fix the magnet gate adjusting screw in this position with a drop of glue.

Additional Cleaning

1) Remove the transfer cradle (12) and the undersize lever (14).
2) Use a pipe cleaner or similar effective cleaning tool to clean the bushings and pivot pins.
3) Replace the transfer cradle and the undersize lever.
4) To be certain the coin mechanism is completely free of any residue, place the mechanism in boiling water for several minutes. Carefully remove it and let it air-dry completely before reinstalling in the door.

Figure 6-8 Adjustments on Coin Mechanism

General Troubleshooting Hints

The first action is to look for jammed coins. After these have been removed, examine the coin path for presence of foreign material or loose objects (such as chewing gum, small metallic objects, paper wads, etc.). In cases where game usage is heavy, it may be necessary to clean the entire coin path periodically, in order to prevent build-up of contaminants that can hinder the movement of coins through the mechanisms. Also confirm that the trip wire on each coin switch is intact, and is properly adjusted. If troubles still persist, check the conditions and positions of the lock-out wires, and the mechanical adjustments on the coin mechanisms, before suspecting the electronics. If a coin mechanism rejects genuine coins, try to readjust it. If this is not successful, then replace it with a working mechanism.

Correct operation of the slam switch can be verified by putting the game into the test mode and performing the switch test (described in Table 1). Correct operation of the other switches and of the lock-out coil can also be checked by the switch test, or else merely by manually operating them and watching game responses as it changes from the attract mode to play mode, and then back to attract mode again.

D. GAME CONTROLS AND PLAYFIELD COMPONENTS

Opening the cabinet and raising the playfield will give access to the playfield components and the game controls—*START* pushbutton switch, flipper switches, pendulum tilt and cabinet tilt switches, Power On/Off Switch, speaker, and the ball shooter.

The game's microcomputer system improves game reliability and significantly reduces maintenance requirements because it replaces conventional electromechanical devices such as step-up rotary switches and motorized trip relay banks. Another game feature is that adjustment-free sealed-contact switches replace all open-contact blade-type switches.

Solenoid Fuses

Plugged onto connector J8 on the Processor PCB is a special miniature PCB assembly that provides individual fuses for each solenoid line. This assembly is identified by the Atari part number A020383. These fuses have been added to prevent the driver transistor from overheating and damaging the surface of the PCB if current flow starts to exceed the maximum fused value.

Whenever a fuse is found to be open, perform the following two checks before replacing the fuse. After making sure that AC power to the game is shut off, first use an ohmmeter to measure the solenoid's DC resistance. Flipper solenoids should have a DC resistance of approximately 7.7 ohms. Hole kickers should have a DC resistance of approximately 18 ohms.

Replace only with 2 amp, 250 volts, slow-blow (3AG) fuses.

Troubleshooting of Playfield Switches Connected in Parallel

As described in Chapter 1, Section D, you can use the switch test both for automatically detecting switches with stuck contacts and for manually identifying switches with stuck contacts and for manually identifying switches whose contacts are not closing properly. But in the instance where contacts from two switches are connected in parallel, additional troubleshooting steps will be needed in order to verify whether or not a given switch is defective.

For example, switch test #46 simultaneously checks all 10-point switches. To confirm which switch is defective, one at a time you must temporarily unsolder the wire to either switch leaf of each switch, while leaving the other switch still connected. Then perform the switch test separately for each switch connected alone.

Wiring connections to the playfield switches are shown in Chapter 5 in the Wiring Diagram, Sheet 2.

E. GAS-DISCHARGE DISPLAYS

The displays are designed to be maintenance-free, so they normally require attention only if incorrect operation is observed. Use the following procedures to isolate and correct problems with the displays.

Preliminary Operational Checks

Make sure that the coin door is closed and locked. Then plug in the power cord and place the Power On/Off Switch in its *on* position. Immediately after AC power is applied, the Score Display should be showing all *8*s and the *PLAYER UP* indications (1ST UP, 2ND UP, etc.) light one at a time, in numerical sequence. All *8*s should be showing in the Credit Display and the Match/Ball Display.

The displays are all operating properly if every display segment lights up at least once. But if one or more segments remain dark, isolate the problem circuitry as described in the following subsection.

Check on +90 and −90 Volts Power Supply Voltages

Remove the playfield glass, then remove the lower arch panel. Troubleshoot the displays as follows:

WARNING

Whenever AC power is applied to the game, voltage potential differences as large as 180 volts are present at the bare terminals of the score panel's edge connector J21, and at various other points on both printed circuit boards.

1. Defeat the Interlock Safety Switch by pulling all the way out on the switch's spring-loaded plunger.

2. Place the Power On/Off Switch in the *on* position.

3. Connect a voltmeter across the following capacitors shown in Figure 6-10, and check for the readings listed below:

   On Match/Credit Display PCB, place meter's ground lead on "plus" side of C4; other lead placed on "plus" side of C3 gives +90 volts reading, and on "minus" side of C4 gives −90 volts reading.

   On Score Panel PCB, place ground lead on "plus" side of C6; other lead on "plus" side of C5 gives +90 volts reading, and on "minus" side of C6 gives −90 volts reading.

4. If one or more readings are low (or at zero volts), check each PCB separately as follows. Disconnect J19 and re-measure the voltages on the Score Display PCB. If the voltages are OK, then some portion of the circuitry on the Match/Credit Display PCB is pulling down the supply voltages. If the voltages are still incorrect, reconnect J19, disconnect J17, and re-measure the voltages on the Match/Credit Display PCB. If voltages are OK, then some portion of the circuitry on the Score Display PCB is pulling down the supply voltages.

   If the voltages remained incorrect while each board was checked separately, leave J17 and J19 both disconnected. Then check the +90 volt and −90 volt outputs on the Auxiliary PCB (where the high voltage power supply circuitry is located). These 90-volt supply voltages must both be present on each display PCB before the displays can light up.

If all voltage readings on the display PCBs are within 5% of the correct values, then go on to the next portion of the procedure.

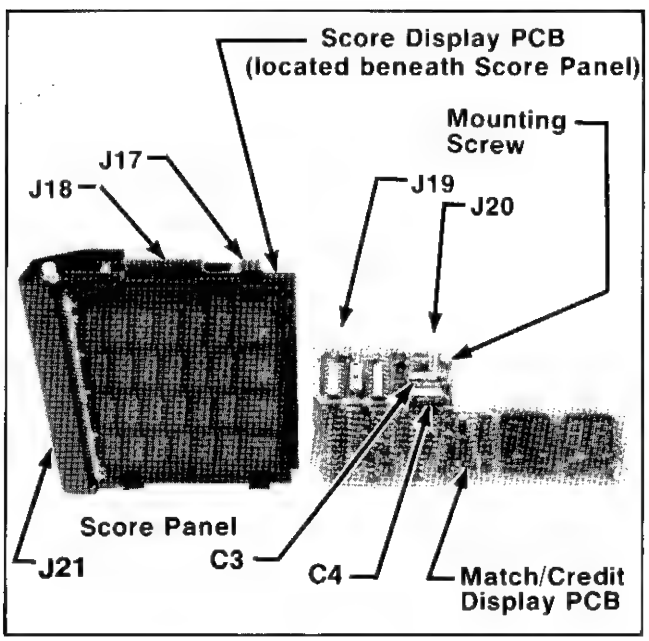


Figure 6-10 Top View of Score and Match/Credit Display Assembly

Score Panel Removal and Visual Checks

After the +90 volt and −90 volt supply voltages have been verified, the next troubleshooting step on the score panel will be to remove it from connector J21.

1. Turn off AC power to the game, preferably by pulling out the power plug from the wall outlet.

2. Remove the metal clips holding the score panel onto the bracket arms of J21 (refer to Figure 6-11).

3. Loosen nylon screws that position the score panel into the score panel connector (refer to Figure 6-11).

WARNING

Glass edges of score panel may be sharp. Use caution to prevent cutting your hands.

4. Using your right hand, grasp the right edge of the score panel. Carefully lift it up approximately ¼-inch, and then pull it straight out and remove it completely.

5. Examine the positions of the terminal pins on J21. Tips of the pins should be aligned in the same plane, as shown in the detail view of Figure 6-10. If not bent out of alignment, all pins can then make contact with the score panel's terminal strips when the panel is plugged in.
6. Next examine the condition of the terminal strips on the score panel. If the surfaces of the strips are corroded, use a pencil eraser to clean them off. Be careful, however, not to rub the eraser against any of the tiny metal ribbons touching certain strips up near the glass "seal" (refer to Figure 6-11). These ribbons must be perfectly centered over the correct pins, not halfway off.

Replacement of Score Panel

After the visual checks have been made on the J21 terminal pins and on the score panel, the original score panel can be put back, or else a new score panel can be substituted in its place. Carefully observe the following procedure when replacing the score panel.

1. Using both hands, grasp the right-hand edge of the panel and carefully slide it fully into connector J21. Then lower the edge down until the entire panel rests in the bracket arms. Adjust the two nylon screws on each side of the score panel connector until score panel terminals are perfectly aligned (refer to Figure 6-10). At the factory a rubbery substance called RTV was placed between the bracket arms and the score panel. This substance provides a cushion between the glass panel and the metal arms, and positions the panel so that connector J21's terminal pins line up exactly with the panel's terminal strips.

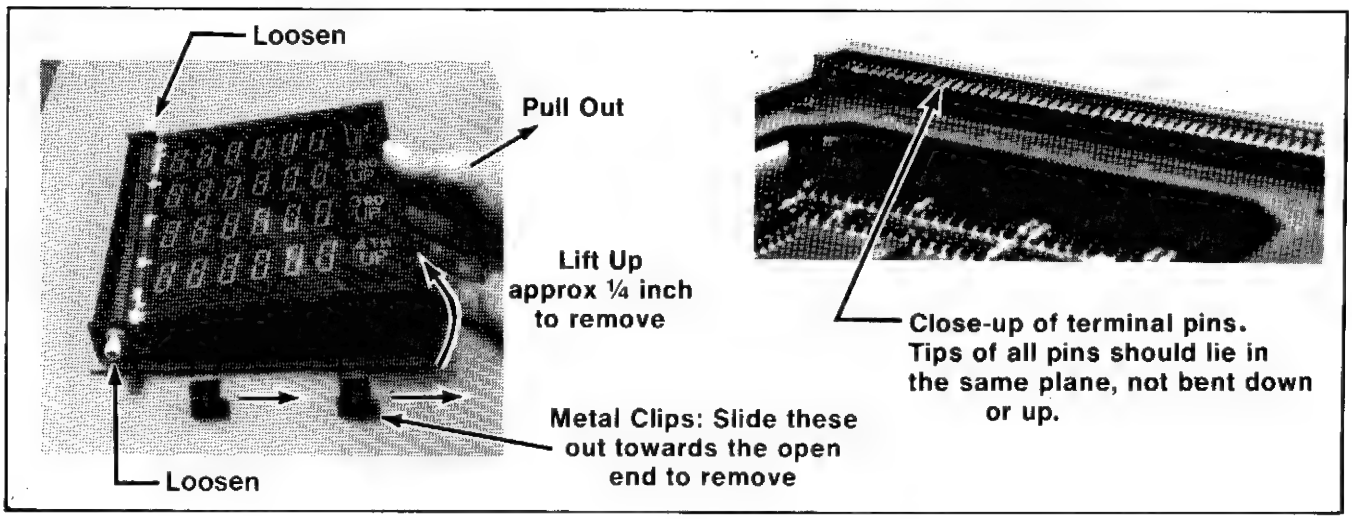


Figure 6-11 Removal of Score Panel

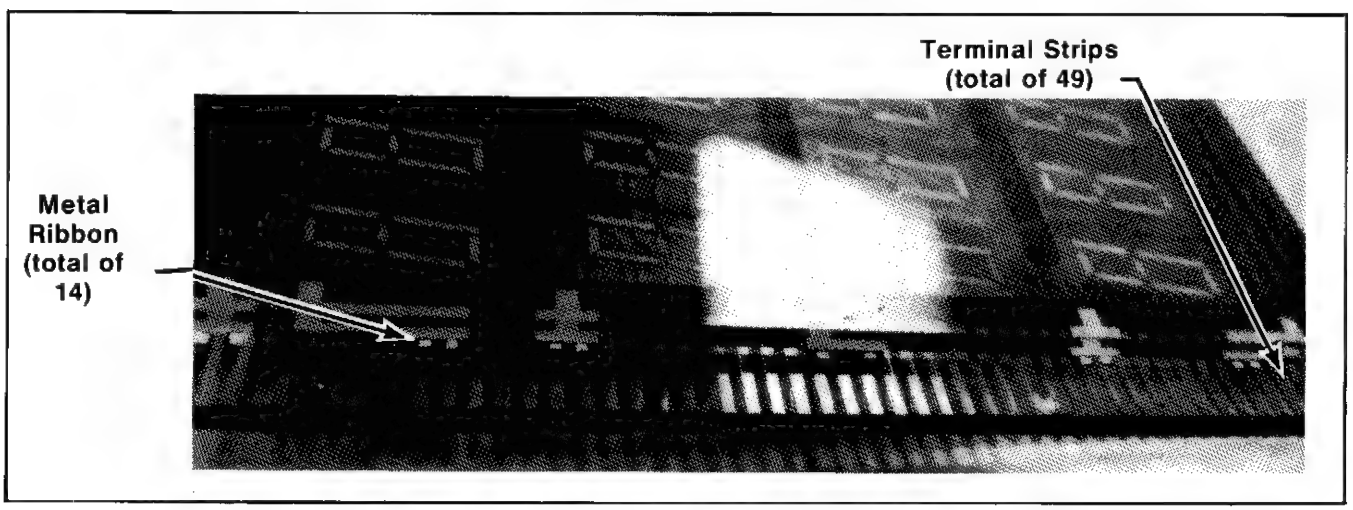
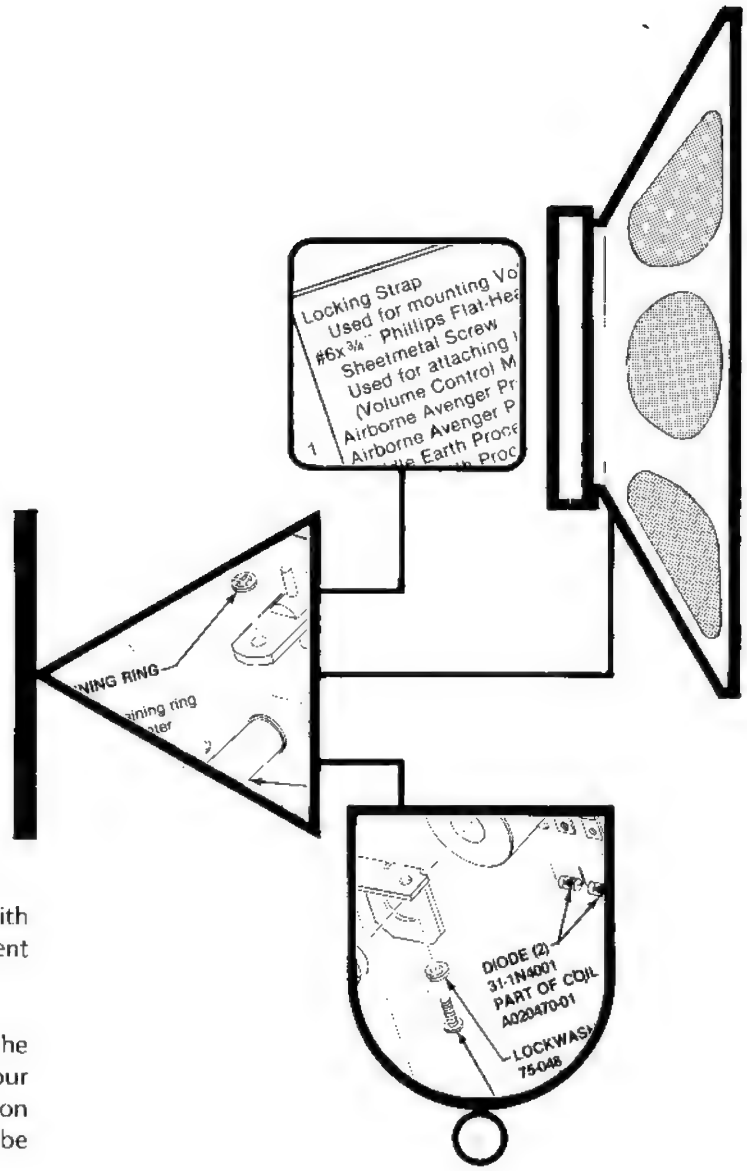


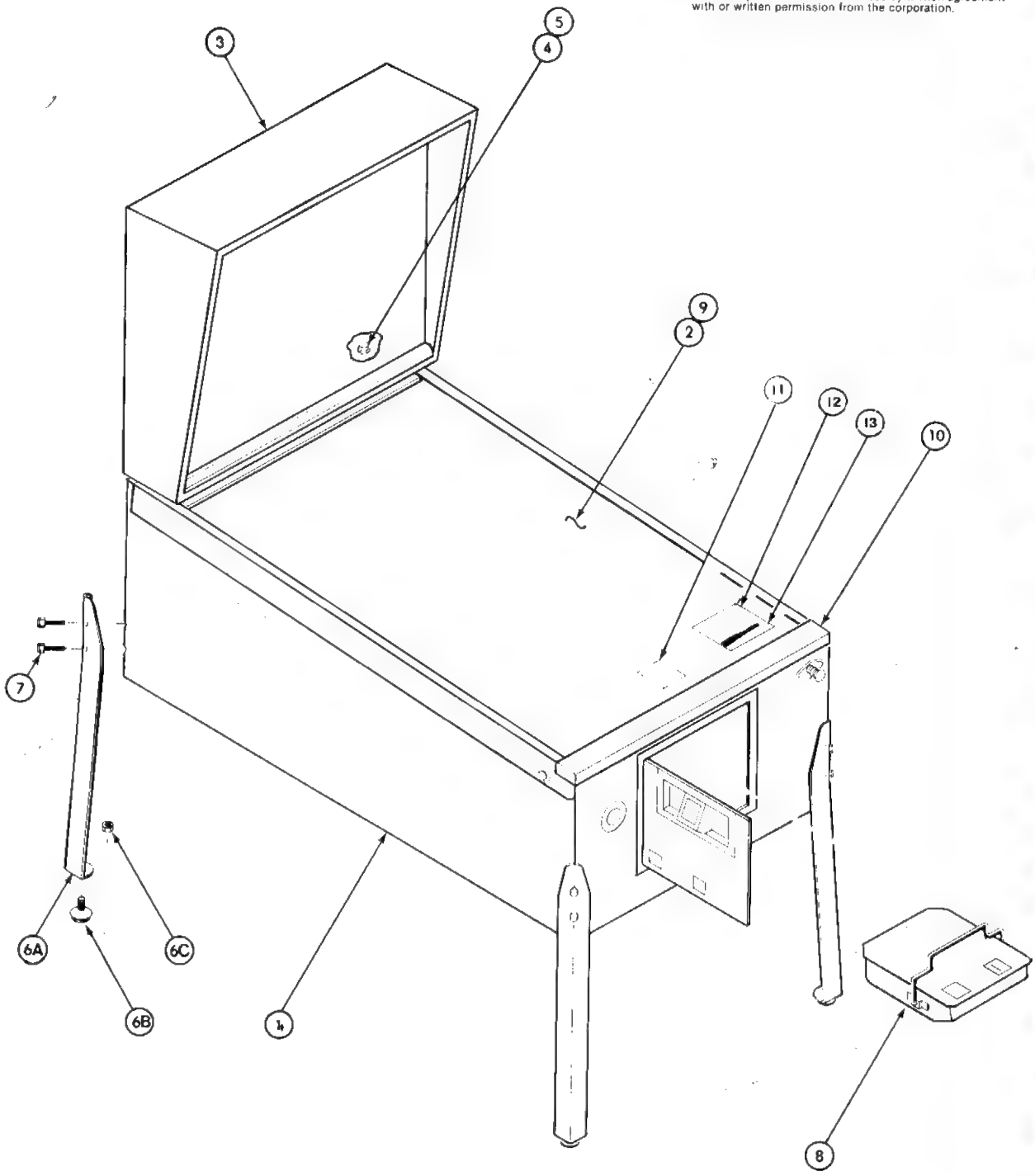
Figure 6-12 Score Panel Terminals

ILLUSTRATED PARTS CATALOG



The purpose of this chapter is to provide you with the necessary information for ordering replacement parts for the Space Riders game.

When ordering parts from your distributor, give the part number, part name, and the serial number of your Space Riders game. This will help to avoid confusion and mistakes in your order. We hope the results will be less downtime and more profit from your game.



NOTE:
SEE OTHER SIDE FOR PARTS LIST

ATARI

FINAL LOCATION ASSEMBLY

THE ATARIANS
SPACE RIDERS

TIME 2000

AIRBORNE AVENGER
MIDDLE EARTH

A006015-01 thru -09
A007850-01 thru -09
A020000-01 thru -09
A020163-01 thru -09
A020902-01 thru -11

Section A
Sheet 1

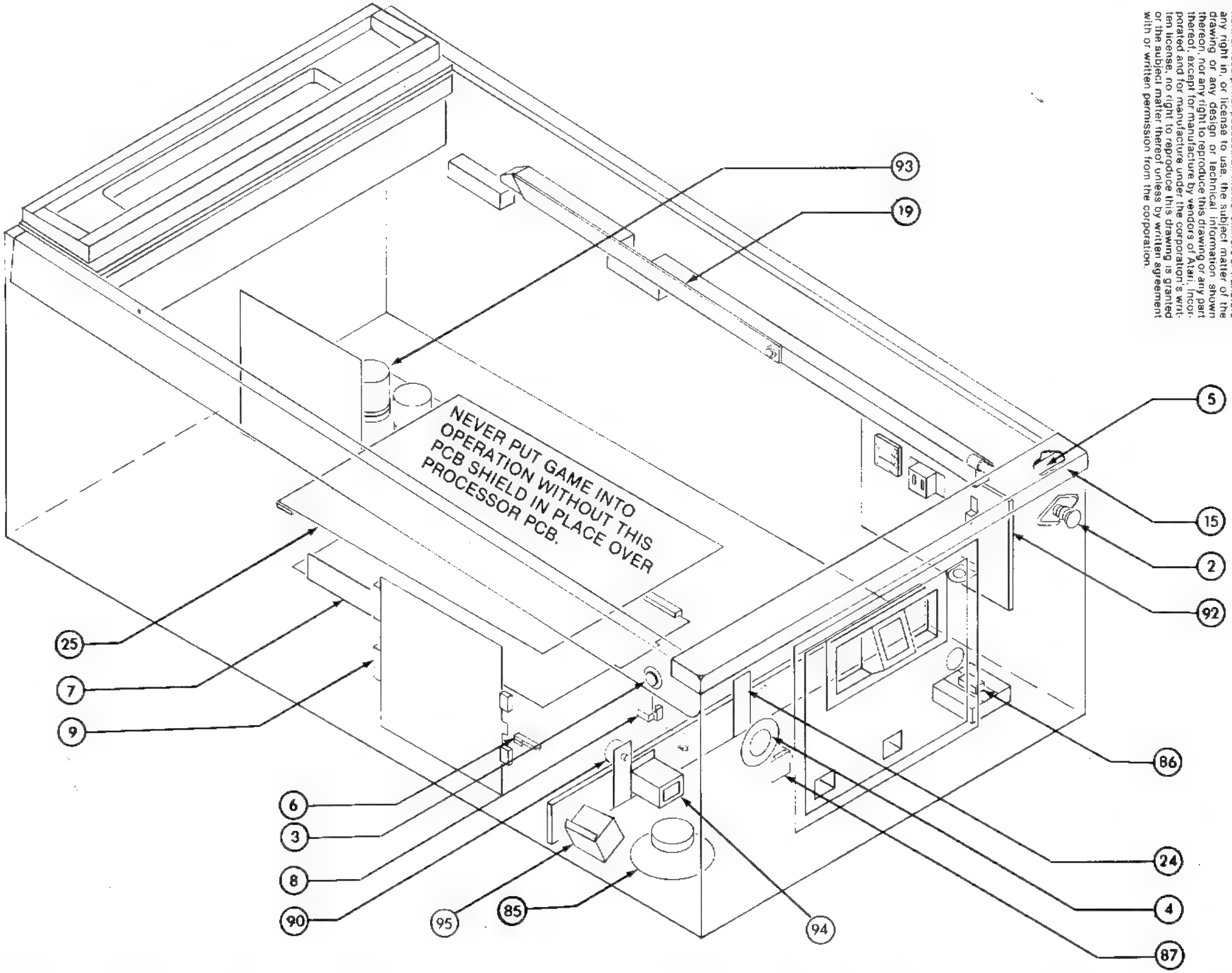
ATARI®

FINAL LOCATION ASSEMBLY

THE ATARIANS
SPACE RIDERS
TIME 2000
AIRBORNE AVENGER
MIDDLE EARTH

A006015-01 thru -09
A007850-01 thru -09
A020000-01 thru -09
A020163-01 thru -09
A020902-01 thru -11

ITEM	PART NUMBER	QTY	DESCRIPTION	FOR MORE INFORMATION
1	A006016-01	1	Cabinet Assembly Used on The Atarians only	
	A006016-02	1	Cabinet Assembly Used on Time 2000 only	
	A006016-03	1	Cabinet Assembly Used on Airborne Avenger only	See Section B, Sheet 2
	A020842-01	1	Cabinet Assembly Used on Middle Earth only	See Section B, Sheet 2
	A020896-01	1	Cabinet Assembly Used on Space Riders only	See Section B, Sheet 2
2	A005988-01	1	Playfield Assembly Used on The Atarians only	
	A007852-01	1	Playfield Assembly Used on Time 2000 only	
	A020002-01	1	Playfield Assembly Used on Airborne Avenger only	
	A020164-01	1	Playfield Assembly Used on Middle Earth only	
	A020894-01	1	Playfield Assembly Used on Space Riders only	See Section F, Sheet 5
3	A006986-01	1	Back Box Assembly Used on The Atarians only	See Section D, Sheet 1
	A006986-02	1	Back Box Assembly Used on Time 2000 only	See Section D, Sheet 1
	A006986-03	1	Back Box Assembly Used on Airborne Avenger only	See Section D, Sheet 1
	A006986-04	1	Back Box Assembly Used on Middle Earth only	See Section D, Sheet 1
	A006986-06	1	Back Box Assembly Used on Space Riders only	See Section D, Sheet 1
4	72-5440X	4	#⅜-16x2.5" Full Thread Hex Head Machine Screw	
5	75-07031	4	Special Purpose Flat Washer with I.D. of 0.436", O.D. of 1", and THK. of 0.88"	
6	A006085-01	1	Legs Kit—Used on The Atarians, Time 2000, Airborne Avenger, and Middle Earth only—Consists of items 6A, 6B, and 6C	
6	A006085-02	1	Legs Kit—Used on Space Riders only—Consists of items 6D, 6E, and 6F	
6A	004999-01	4	Leg—Part of Legs Kit A006085-01	
6B	78-3201	4	#⅜-16x1.5" Adjustable Swivel Guide—Part of Legs Kit A006085-01	
6C	75-919C	4	#⅜-16 Standard Pattern Hexagon CRES Machine Nut—Part of Legs Kit A006085-01	
6D	004999-04	4	Leg—Part of Legs Kit A006085-02	
6E	78-3203	4	#3/8-16x1.5" Adjustable Swivel Guide—Part of Legs Kit A006085-02	
6F	75-919C	4	#3/8-16 Standard Pattern Hexagon CRES Machine Nut—Part of Legs Kit A006085-02	
7	72-P938N	8	#⅜-16x2⅜" Nickel Plated Acorn Head Machine Screw	
8	A007902-01	1	Cash Box Assembly—Consists of items 8A, 8B, and 8C	
8A	006316-01	1	Cash Box—Part of Cash Box Assembly A007902-01	
8B	006317-01	1	Cash Box Lid—Part of Cash Box Assembly A007902-01	
8C	006445-01	1	Cash Box Handle—Part of Cash Box Assembly A007902-01	
9	005957-01	1	Playfield Glass	
10	A020725-01	1	Playfield Glass Front Moulding Assy	
11	007040-XX	1	Package of Time 2000 Instruction, Coinage, and Replay Level cards	
11	020264-XX	1	Package of Airborne Avenger Replay Level and Coinage cards	
11	020293-XX	1	Package of Middle Earth Replay Level cards	
11	020294-XX	1	Package of Space Riders Replay/-Coinage cards	
12	020263-01	1	Airborne Avenger Instruction card	
12	020292-01	1	Middle Earth Instruction card	
12	020904-01	1	Space Riders Instruction card	
13	020294-XX	1	Package of Middle Earth Coinage cards	
	020295-01	1	5X Scoring label, for Middle Earth only Not identified on drawing	
	TM-086	1	The Atarians Operation, Maintenance and Service Manual	
	TM-099	1	Time 2000 Operation, Maintenance and Service Manual	
	TM-102	1	Airborne Avenger Operation, Maintenance and Service Manual	
	TM-108	1	Middle Earth Operation, Maintenance and Service Manual	
	TM-119	1	Space Riders Operation, Maintenance and Service Manual	



Section B
Sheet 2

A006016-03
A020842-01
A020896-01

CABINET ASSEMBLY

SPACE RIDERS

AIRBORNE AVENGER
MIDDLE EARTH

ATARI

ITEM	PART NUMBER	QTY	DESCRIPTION	FOR MORE INFORMATION
2	A004769-01	1	Ball Shooter	See Section C, Sheet 1
	75-940S	2	#10-32 Polymer Self-Locking Hex Nut Used for attaching Ball Shooter	
3	A004910-01	2	Flipper Button—Used on Middle Earth only	
	72-6608S	4	#6x½" Cross-Recessed Type AB Pan-Head Thread-Forming Steel Screw Used for mounting Flipper Buttons	
3	A020895-01	2	Flipper Button—Used on Space Riders only	See Section C, Sheet 13
4		1	Start Button	See Section C, Sheet 18
	020436-01	1	Start Button Safety Cover Used to cover Wire-Terminals	
	75-5820B	4	#8-32x1¼" Black Steel Square-Neck Round-Head Carriage Bolt Used for attaching Start Button	
	75-948S	4	#8-32 Polymer Self-Locking Steel Hex Nut Used for attaching Start Button	
5	A005956-01	1	Locking Base Assy	
	72-6810S	6	#6x⅝" Cross-Recessed Type AB Pan-Head Thread-Forming Steel Screw Used for attaching Locking Base Assy	
6	004742-01	1	Slam Switch	
	72-6412S	2	#4x¾" Cross-Recessed Type AB Pan-Head Thread-Forming Steel Screw Used for attaching Slam-Switch Assy	
7	A020383-04	1	Fuse Board Used on Airborne Avenger only	
	A020383-06	1	Fuse Board Used on Middle Earth and Space Riders only	
8	A006071-01	1	Flipper Button Switch—Not used on Space Riders	
8	A020931-01	2	Flipper Button Switch—Used only on Space Riders	See Section C, Sheet 13
	72-6608S	4	#6x½" Cross-Recessed Type AB Pan-Head Thread-Forming Steel Screw Used for attaching Flipper Button Switches	
9	A006407-01	1	Auxiliary PCB	See Section C, Sheet 36
	006762-01	4	Shockmount Spring Used for mounting Auxiliary PCB	
	72-1608S	4	#6-32x½" Cross-Recessed Pan-Head Steel Machine Screw Used for attaching Auxiliary PCB to Shockmount Springs	
	75-016S	4	#6 Regular Pattern Plain Flat-Washer Used for attaching Auxiliary PCB to Shockmount Springs	
	75-946S	4	#6-32 Polymer Self-Locking Steel Hex Nut Used for attaching Auxiliary PCB to Shockmount Springs	
	72-6810S	4	#8x⅝" Cross-Recessed Type AB Pan-Head Thread-Forming Steel Screw Used for attaching Shockmount Springs to Cabinet	
	75-018S	4	#8 Regular Pattern Plain Flat-Washer Used for attaching Shockmount Springs to Cabinet	
8A	021105-01	2	Leaf Switch Header Plate	See Section C, Sheet 13

ITEM	PART NUMBER	QTY		FOR MORE INFORMATION
10	A007866-01	1	Airborne Avenger PCB Power Harness Not identified on drawing	
10	A020418-01	1	Middle Earth and Space Riders PCB Power Harness	
11	A007868-01	1	PCB Interconnect Harness Not identified on drawing	
12	A020023-01	1	Display Harness Not identified on drawing	
13	A020235-01	1	Total Play Harness Not identified on drawing	
19	004989-01	2	Support Arm	
	004902-01	2	Flang Bushing Used for attaching Support Arm	
	72-6820S	2	#8x1¼" Cross-Recessed Type AB Pan-Head Thread-Forming Steel Screw Used for attaching Support Arm thru Flang Bushing and into Cabinet	
	020440-01	1	Right Stay Arm Bracket Used to support Support Arm	
	020440-02	1	Left Stay Arm Bracket Used to support Support Arm	
	72-6608S	2	#6x½" Cross-Recessed Type AB Pan-Head Thread-Forming Steel Screw Used for mounting right and left Stay Arm Brackets	
20	A020635-01	1	Coin Door for 25-Cent Operation	Section C, Sheet 31
	A020635-02	1	Coin Door for 5-Franc Operation	Section C, Sheet 31
	A020635-03	1	Coin Door for 1-Deutschmarc Operation	Section C, Sheet 31
	A020635-04	1	Coin Door for 1-Krona Operation	Section C, Sheet 31
	A020635-05	1	Coin Door for 100-Yen Operation	Section C, Sheet 31
	A020635-06	1	Coin Door for 10-New Pence Operation	Section C, Sheet 31
	A020635-07	1	Coin Door for Australian 20-Cent Operation	Section C, Sheet 31
	A020635-08	1	Coin Door for ½-Deutschmark Operation	Section C, Sheet 31
	A020635-09	1	Coin Door for 1-Franc Operation	Section C, Sheet 31
	A020635-10	1	Coin Door for 1-Baht Operation	Section C, Sheet 31
	A020635-11	1	Coin Door for 1/5-Deutschmark Operation	Section C, Sheet 31
	A020635-12	1	Coin Door for 100-Lira Operation	Section C, Sheet 31
24	006719-01	1	Cash Box Locking Strap	
	75-B612	2	#6x¾" Phillips Flat-Head Type AB Sheetmetal Screw Used for attaching Cash Box Locking Strap	
	75-015S	4	#¼ Regular Pattern Steel Plain Flat-Washer Used for attaching Cash Box Locking Strap	
25	021137-01	1	Black Plastic Processor PCB Shield Never put game into operation without PCB Shield in place	
27	006019-01	4	Retaining Bracket Used for mounting Black Plastic Processor PCB Shield	
	72-1804S	4	#8-32x¼" Cross-Recessed Pan-Head Steel Machine Screw Used for attaching Black Plastic Processor PCB Shield to Retaining Brackets	
	75-018S	4	#8 Regular Pattern Plain Steel Flat-Washer Used for attaching Black Plastic Processor PCB Shield to Retaining Brackets	
	72-6810S	4	#8x5/8" Cross-Recessed Type AB Pan-Head Thread-Forming Steel Screw Used for attaching Retaining Brackets to Cabinet	
85	48-004	1	5", 8 ohm, Speaker	
	000869-01	1	Speaker Grill	
	72-1608S	4	#6-32x½" Cross-Recessed Pan-Head Steel Machine Screw Used for attaching Speaker and Speaker Grill	
	75-056	4	#6 Internal-Tooth Steel Lock-Washer Used for attaching Speaker and Speaker Grill	
86	61-062A	1	15Amp @ 125 VAC General Purpose Toggle Switch — Cherry #E69-50A	
	006450-01	1	Switch Plate Used for mounting Toggle Switch	
	72-6810S	2	#8x5/8" Cross-Recessed Type AB Pan-Head Thread-Forming Steel Screw Used for attaching Switch Plate to Cabinet	
	020435-01	1	Power ON/OFF Safety Switch Cover	
	72-6810S	4	#8x5/8" Cross-Recessed Type AB Pan-Head Thread-Forming Steel Screw Used for attaching Safety Switch Cover	
87	68-002	1	30Amp Interlock Switch—Cherry #E79-30A	
	000268-02	1	Interlock Switch Mounting Bracket	
	72-6810S	2	#8x5/8" Cross-Recessed Type AB Pan-Head Thread-Forming Steel Screw Used for attaching Mounting Bracket to Cabinet	
	020435-02	1	Interlock Switch Safety Cover	
90	19-9030	1	100 ohm, 3W, Wire-Wound Linear Variable Resistor Used as the Operator Accessible Volume Control	

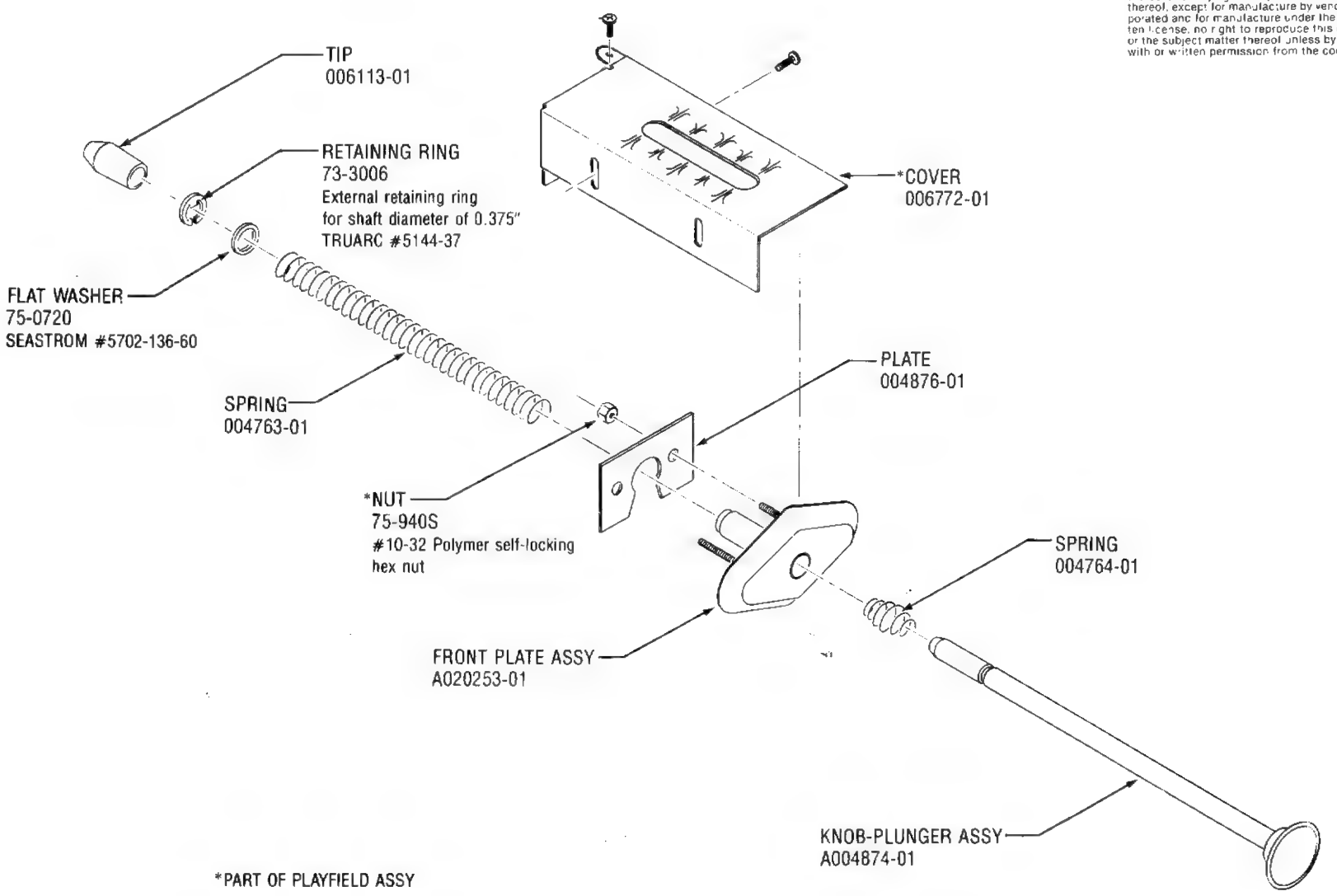
ATARI

CABINET ASSEMBLY

THE ATARIANS
SPACE RIDERS
TIME 2000
AIRBORNE AVENGER
MIDDLE EARTH

A006016-03
A020842-01
A020896-01

ITEM	PART NUMBER	QTY	DESCRIPTION	For More Information
	006719-01	1	Locking Strap Used for mounting Volume Control	
	75-B612	1	#6x¾" Phillips Flat-Head Type AB Sheetmetal Screw Used for attaching Locking Strap (Volume Control Mount)	
91	A006020-08	1	Airborne Avenger Processor PCB	See Section C, Sheet 42
91	A006020-09	1	Airborne Avenger Processor PCB	See Section C, Sheet 42
91	A006020-11	1	Middle Earth Processor PCB	See Section C, Sheet 43
91	A006020-14	1	Middle Earth Processor PCB	See Section C, Sheet 43
91	A006020-15	1	Middle Earth Processor PCB	See Section C, Sheet 43
91	A006020-16	1	Middle Earth Processor PCB	See Section C, Sheet 43
91	A006020-17	1	Space Riders Processor PCB	See Section C, Sheet 44
91	A006020-18	1	Space Riders Processor PCB	See Section C, Sheet 44
	006762-01	4	Shockmount Spring Used for mounting Processor PCB—Used on Middle Earth only	
	72-1608S	4	#6-32x½" Cross-Recessed Pan-Head Steel Machine Screw Used for attaching Processor PCB to Shockmount Springs—Used on Middle Earth only	
	75-016S	4	#6 Regular Pattern Plain Flat-Washer Used for attaching Processor PCB to Shockmount Springs—Used on Middle Earth only	
	75-946S	4	#6-32 Polymer Self-Locking Steel Hex Nut Used for attaching Processor PCB to Shockmount Springs—Used on Middle Earth only	
	72-6810S	4	#8x5/8" Cross-Recessed Type AB Pan-Head Thread-Forming Steel Screw Used for attaching Shockmount Springs to Cabinet—Used on Middle Earth only	
	75-018S	4	#8 Regular Pattern Plain Flat-Washer Used for attaching Shockmount Springs to Cabinet—Used on Middle Earth only	
	A020718-01	4	PCB Mounting Bracket—Used on Space Riders only	
	72-6810S	4	#8x5/8" Cross-Recessed Type AB Pan-Head Thread-Forming Steel Screw—Used for attaching PCB Mounting Bracket to Cabinet	
	75-048	4	#8 Stainless Steel Split-Lock Washer	
92	A006728-03	1	95/117V Tilt Board—Used on Middle Earth only Used on American and Japanese games only	
92	A006728-04	1	205/220V Tilt Board—Used on Middle Earth only Not used on German games	
92	A006728-05	1	205/220V Tilt Board—Used on Middle Earth only Used on German games only	
92	A006728-06	1	95/117V Tilt Board—Used on Space Riders only—Used on American and Japanese games only	See Section C, Sheet 8
92	A006728-07	1	205/220V Tilt Board—Used on Space Riders only—Not used on German games	See Section C, Sheet 8
92	A006728-08	1	205/220V Tilt Board—Used on Space Riders only—Used on German games only	See Section C, Sheet 8
	72-6616	4	#6x1" Cross-Recessed Type AB Pan-Head Thread-Forming Steel Screw Used for attaching Tilt Board to Cabinet	
93	A006032-04	1	117V Power Supply Used on U.S. version of Airborne Avenger only	
93	A006032-05	1	220V Power Supply Used on European version of Airborne Avenger only	
93	A006032-06	1	220V Power Supply Used on Australian version of Airborne Avenger only	
93	A006032-07	1	95V Power Supply Used on Japanese version of Airborne Avenger only	
93	A006032-08	1	220V Power Supply Used on English version of Airborne Avenger only	
93	A006032-09	1	117V Power Supply Used on American games only	
93	A006032-10	1	220V Power Supply Used on Belgian, German, and Scandinavian games only	See Section C, Sheet 24
93	A006032-11	1	220V Power Supply Used on English games only	See Section C, Sheet 24
93	A006032-12	1	220V Power Supply Used on Australian games only	See Section C, Sheet 24
	72-B512	4	#¼-20x¾" Hex-Head Steel Bolt Used for attaching Power Supply to Cabinet	
	75-045	4	#¼" CRES Split Lock-Washer Used for attaching Power Supply to Cabinet	
	75-015S	4	#¼ Regular Pattern Plain Steel Flat-Washer Used for attaching Power Supply to Cabinet	
94	A002465-01	1	Counter Assy for Airborne Avenger only	
	72-6810S	2	#8x5/8" Cross-Recessed Type AB Pan-Head Thread-Forming Steel Screw	
95	A002465-01	1	Counter Assy for Middle Earth only	
	72-6810S	2	#8x5/8" Cross-Recessed Type AB Pan-Head Thread-Forming Steel Screw	

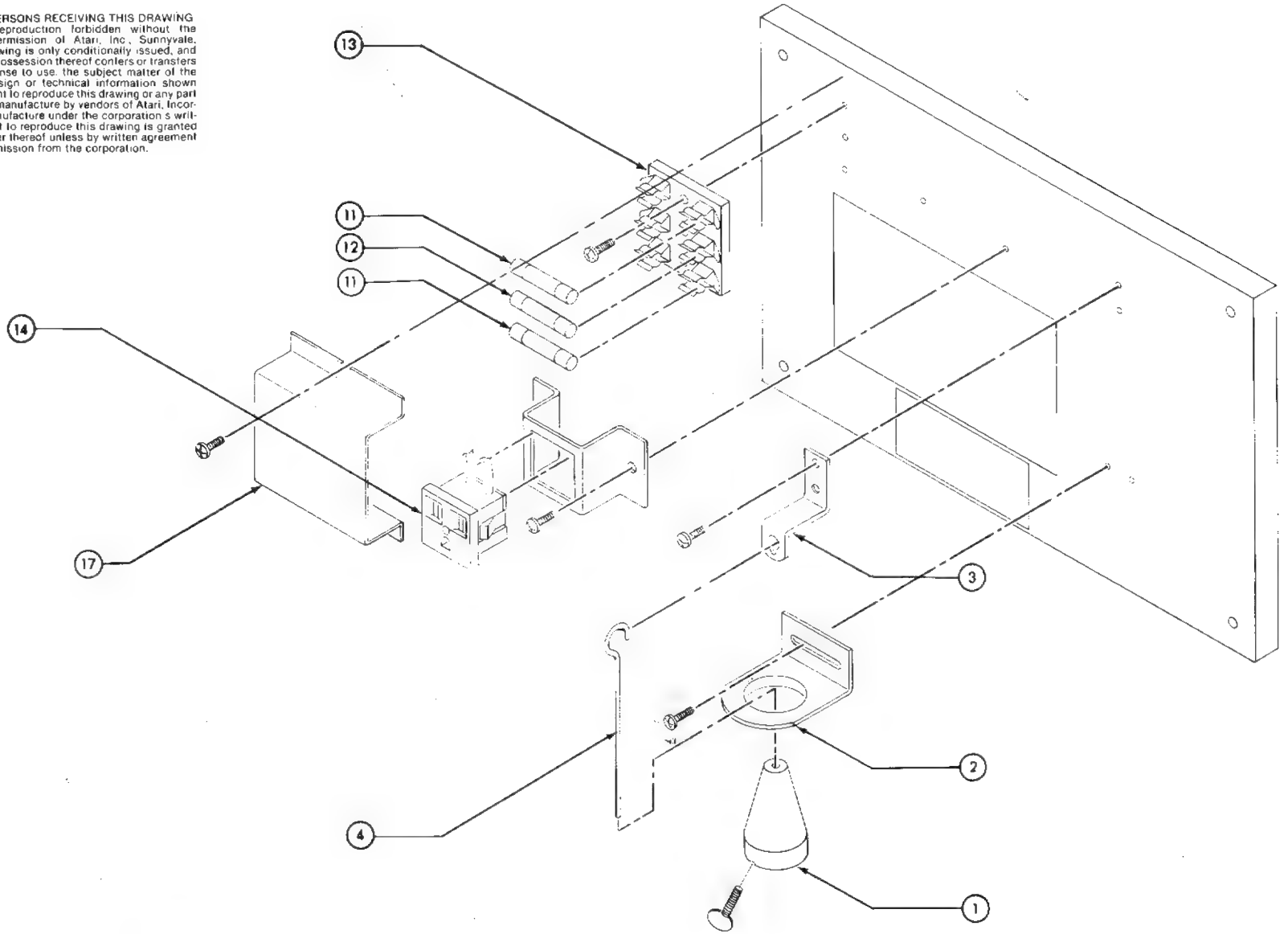


*PART OF PLAYFIELD ASSY

BALL SHOOTER
A004769-01

CABINET SUB-ASSEMBLY

ATARI®



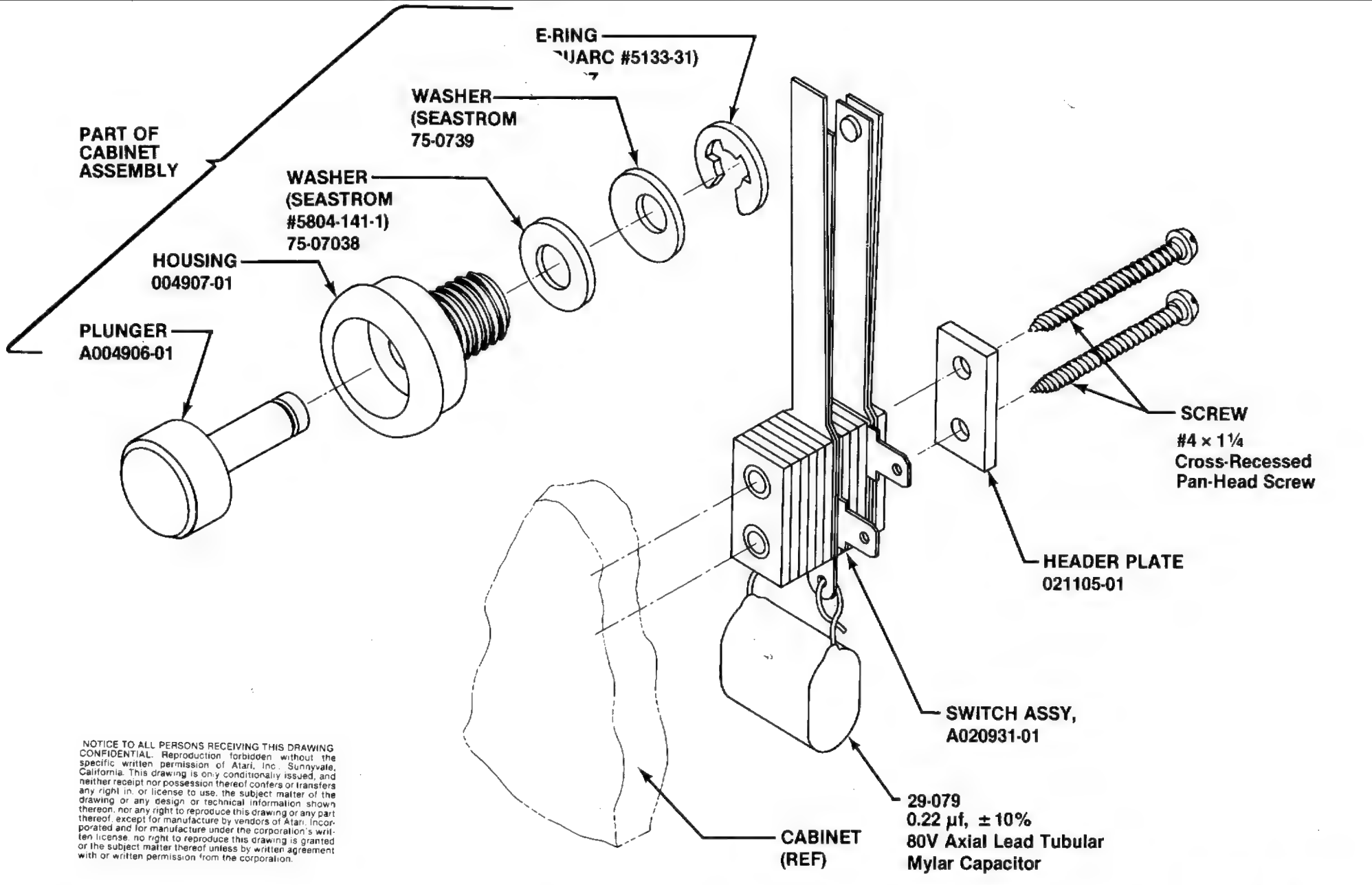
NOTE:
SEE OTHER SIDE FOR PARTS LIST

TILT BOARD
A006728-06 thru -08

CABINET SUB-ASSEMBLY

ATARI®

DESIG-NATION	ITEM	PART NUMBER	DESCRIPTION
F7	11	46-2032002	2Amp @ 250V 3AG Normal-Blow Fuse—LITTLEFUSE #312002
F8	12	46-2017002	7Amp @ 250V 3AG Slow-Blow Fuse—LITTLEFUSE #313007 Used on 95/117V Tilt Board A006728-06 only
F8	12	46-2014002	4Amp @ 250V 3AB Slow-Blow Fuse—BUSSMAN #MDA 4 Used on 205/220V Tilt Board A006728-07 and -08 only
F9	11	46-2032002	2Amp @ 250V Normal-Blow Fuse—LITTLEFUSE #312002
	13	79-3203	Three-Station Fuse Holder—LITTLEFUSE #357003 Used for mounting Fuses F7 thru F9
	18	75-6608S	#6x½" Self-Tapping Steel Sheetmetal Screw Quantity of three used for attaching Fuse Holder
	17	007882-01	Fuse Holder Cover
J32	14	79-5303	125V, 15Amp, Standard U.S. Grounded A.C. Service Outlet Used on Tilt Board A006728-06 and -07 only
	6	007016-01	Service Outlet Bracket Used on Tilt Board A007728-06 and -07 only
	18	75-6608S	#6x½" Self-Tapping Steel Sheetmetal Screw Quantity of two used for attaching Service Outlet Bracket
S10			Pendulum Tilt Switch Assembly—Consists of the following:
	1	004889-01	Pendulum Tilt Weight
	2	004890-01	Pendulum Tilt Contact Ring
	9	75-6606S	#6x⅜" Self-Tapping Steel Sheetmetal Screw Quantity of two used for attaching Contact Ring
	3	004891-01	Pendulum Tilt Mounting Bracket
	9	75-6606S	#6x⅜" Self-Tapping Steel Sheetmetal Screw Quantity of two used for attaching Mounting Bracket
	4	004895-01	Pendulum Tilt Shaft
	10	82-0816	#8-32x1" Mild-Steel Thumb Screw

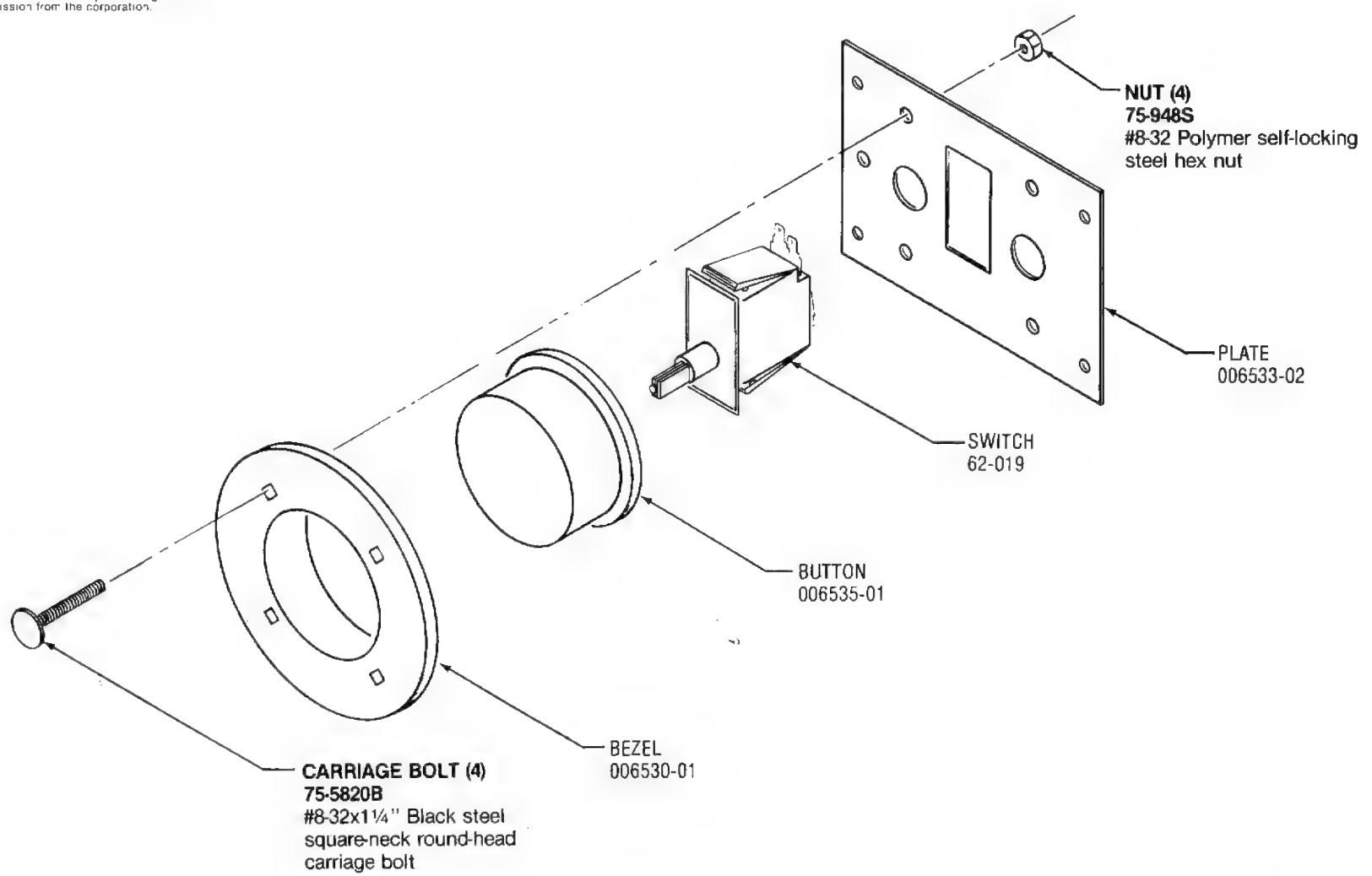


FLIPPER BUTTON
A020895-01

FLIPPER BUTTON SWITCH
A020931-01

CABINET SUB-ASSEMBLY

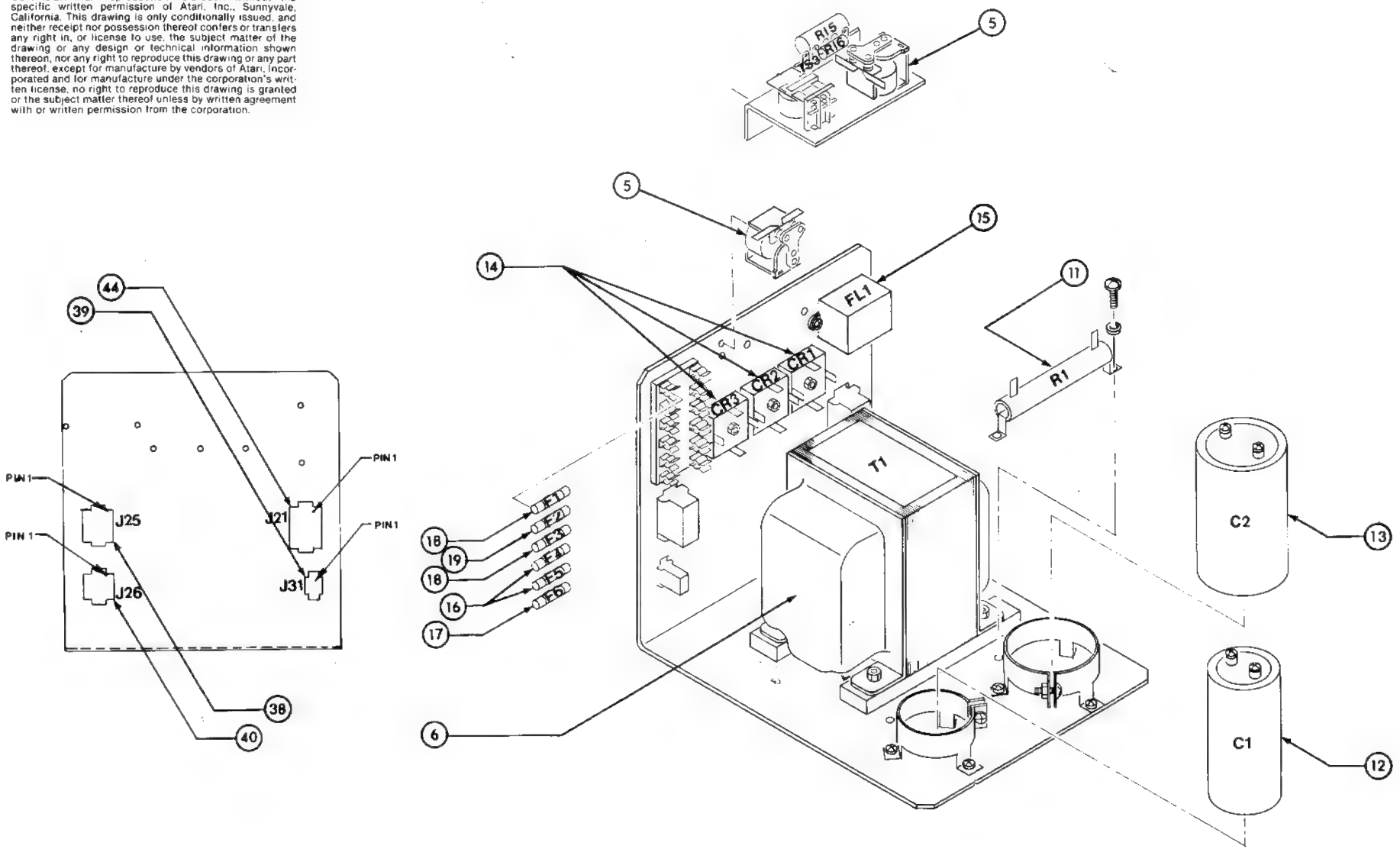
ATARI®



START BUTTON

CABINET SUB-ASSEMBLY

ATARI®



POWER SUPPLY
A006032-10 thru -12
A021089-01 and -02

CABINET SUB-ASSEMBLY

ATARI®

DESIG-NATION	ITEM	PART NUMBER	QTY	DESCRIPTION
		A007355-01	1	Power Supply Tray Harness Connects to Resistor R1, Capacitors C1 and C2, etc. Not identified on drawing
		A007810-01	1	Power Supply Harness Connects to Filter FL1, Connectors J25 and J26, etc. Not identified on drawing
		A007813-02	1	Three Conductor Power Cord with Standard U.S. Grounded Plug Used on A006032-09, -11, and -13 Power Supplies only Not identified on drawing
		A007813-03	1	Two Conductor Power Cord with European Plug Used on A006032-10 Power Supply only Not identified on drawing
		A007813-04	1	Three Conductor Power Cord with Australian Plug Used on A006032-12 Power Supply only Not identified on drawing
		A020025-01	1	Shorting Plug—Mates with Connector J26 Used for 95V operation on A006032-13 Power Supply only Not identified on drawing
		A020025-02	1	Shorting Plug—Mates with Connector J26 Used for 220V operation on A006032-10, -11, and -12 Power Supplies only Not identified on drawing
		A020025-03	1	Shorting Plug—Mates with Connector J26 Used for 117V Operation A006032-09 Power Supply only Not identified on drawing
C1	12	29-057	1	18,000uf, +75%, −10%, 25WVDC, Electrolytic Capacitor—SPRAGUE #36D183G025BC2A
		78-70501SC	1	Capacitor Mounting Bracket—SPRAGUE #4586-48 Used for mounting Capacitor C1
C2	13	29-058	1	21,000uf, +75%, −10%, 40WVDC, Electrolytic Capacitor—SPRAGUE #36D213G040CC2A
		78-70503SC	1	Capacitor Mounting Bracket—MALLORY #VR10 Used for mounting Capacitor C1
		72-1608S	2	#6-32x½" Cross-Recessed Pan-Head Steel Machine Screw Used for clamping Capacitors C1 and C2
		75-056	2	#6 Internal Tooth Steel Lock-Washer Used for clamping Capacitors C1 and C2
		75-916S	2	#6-32 Standard Pattern Hex Nut Used for clamping Capacitors C1 and C2
		72-1604S	6	#6-32¼" Cross-Recessed Pan-Head Steel Machine Screw Used for attaching Capacitors C1 and C2 Mounting Brackets

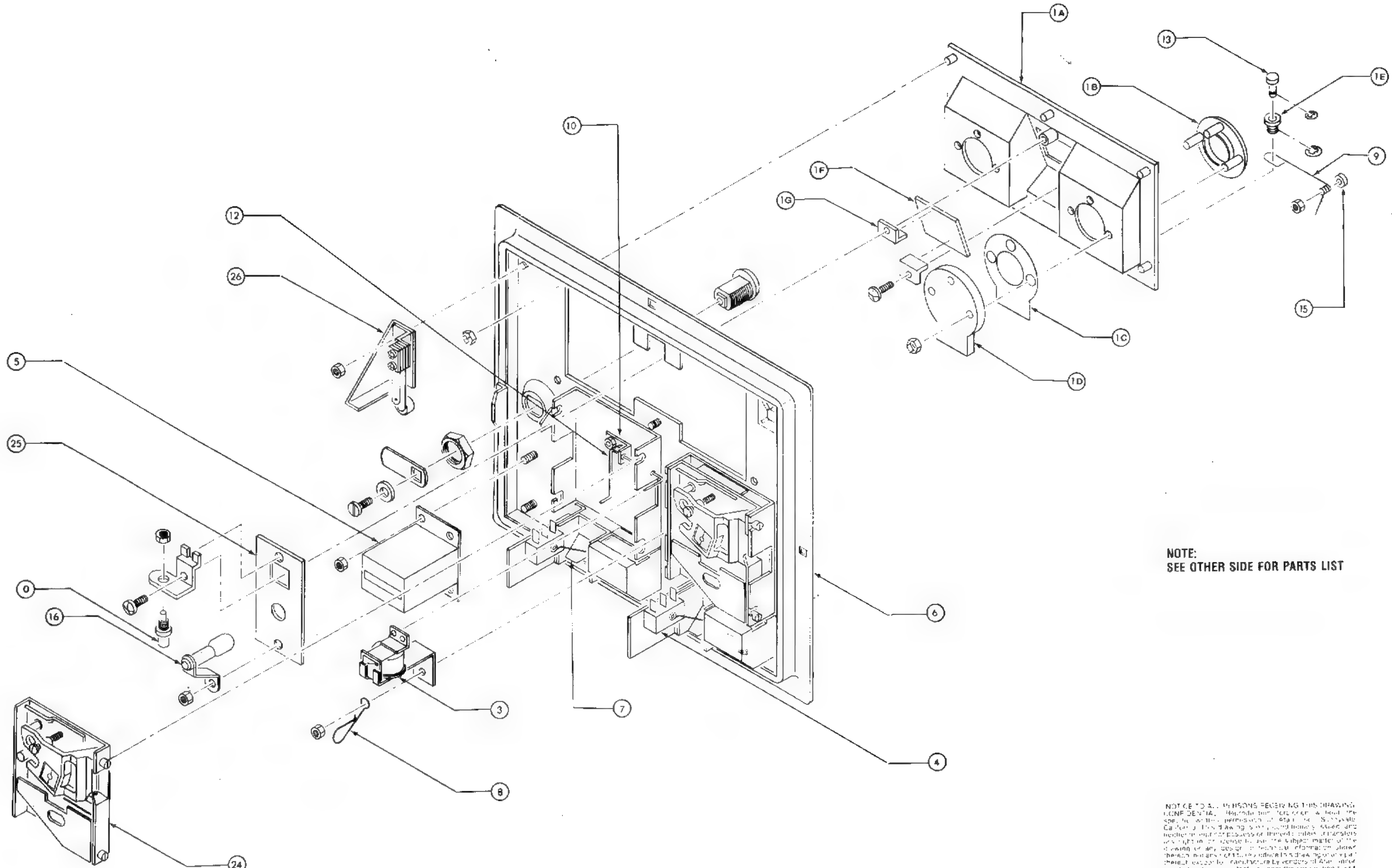
DESIG-NATION	ITEM	PART NUMBER	QTY	DESCRIPTION
		75-056	6	#6 Internal Tooth Steel Lock Washer Used for attaching Capacitors C1 and C2 Mounting Brackets
		72-1006S	4	#10-32x⅜" Cross-Recessed Pan-Head Steel Machine Screw Used for attaching wires to Capacitors C1 and C2
		75-040C	4	#10 CRES Split-Lock-Washer Used for attaching wires to Capacitors C1 and C2
CR1–CR3	14	3A-MDA3500	3	Bridge Rectifier—MOTOROLA #MDA3500
		72-1112S	3	#10-24x¾" Cross-Recessed Pan-Head Steel Machine Screw Used for attaching Rectifiers CR1 thru CR3
		75-040C	3	#10 CRES Split-Lock Washer Used for attaching Rectifiers CR1 thru CR3
		79-07416V	12	Fixed Insulated Terminal—HOLLINGSWORTH #S09721SF Used for attaching wires to Recitifiers CR1 thru CR3
F1	18	46-305152	1	15Amp @ 250V 3AB Normal-Blow Fuse—LITTLEFUSE #314015
F2	19	46-2017002	1	7Amp @ 250V 3AG Slow-Blow Fuse—LITTLEFUSE #313007
F3	18	46-305152	1	15Amp A 250V 3AB Normal-Blow Fuse—LITTLEFUSE #314015
F4, F5	16	46-2010502	2	½Amp @ 250V 3AG Slow-Blow Fuse—LITTLEFUSE #313500
F6	17	46-2032002	1	2Amp @ 250V 3AG Normal-Blow Fuse—LITTLEFUSE #312002
		79-3204	1	Six-Station Fuse Holder—LITTLEFUSE #357006 Used for mounting Fuses F1 thru F6
		72-1606S	2	#6-32x⅜" Cross-Recessed Pan-Head Steel Machine Screw Used for attaching Fuseholder
		75-056	2	#6 Internal Tooth Steel Lock-Washer Used for attaching Fuseholder
FL1	15	41-2008	1	10Amp RFI Filter
		72-1604S	2	#6-32-¼" Cross-Recessed Pan-Head Steel Machine Screw Used for attaching Filter FL1
		75-056	2	#6 Internal Tooth Steel Lock-Washer Used for attaching Filter FL1
		79-07416V	4	Fixed Insulated Terminals—HOLLINGSWORTH #S09721SF Used for attaching wires to Filter FL1
J21	44	79-58119	1	Fifteen-Pin Connector—AMP #1-480711-0
J25	38	79-58084	1	Twelve-Pin Connector—AMP #10480709-0
J26	40	79-58117	1	Nine-Pin Connector—AMP #1-480707-0
J31	39	79-58134	1	Two-Pin Connector—AMP #1-480699-0
	35	79-20123	29	Connector Pin Contact—AMP #350547-1
	5	A021090-01	1	Relay Kit—Used on A021089-01 and -02 Power supplies only. Consists of Relay K22 and diodeCR22
	5	A020317-02	1	Replay Kit—Used on A006032-10, -11, and -12 Power Supplies only Consists of Relays K21, K22, Resistors R15 and R16, Diode CR22, and Terminal Strip TS3

ATARI®

CABINET SUB-ASSEMBLY

POWER SUPPLY
A006032-10 thru -12
A021089-01 and -02

DESIG-NATION	ITEM	PART NUMBER	QTY	DESCRIPTION
		72-1606S	2	#6-32x3/8" Cross-Recessed Pan-Head Steel Machine Screw Used for attaching Relay Kit to Power Supply Tray
		75-916S	2	#6-32 Standard Pattern Hex Nut Used for attaching Relay Kit to Power Supply Tray
K21	5A	43-4004	1	6VDC, 5Amp, SPDT Relay— POTTER & BRUMFIELD #KA5DY-6V
		75-046	1	#6 Internal Tooth Steel Lock-Washer Used for mounting Relay K21
		75-916S	1	#6-32 Standard Pattern Hex Nut Used for mounting Relay K21
K22	5B	43-4008	1	24VDC, 20Amp, SPST Relay— POTTER & BRUMFIELD #KR3DH-24V
		75-046	1	#6 Internal Tooth Steel Lock-Washer Used for mounting Relay K22
		75-916S	1	#6-32 Standard Pattern Hex Nut Used for mounting Relay K22
R15	5C	19-10100007	1	10 Ohm, ±5%, 20W, Wirewound Fixed Resistor— OHMITE #1804
R16	5D	12-5180	1	18 Ohm, ±5%, 1W, Carbon Composition Resistor
TS3	5E	79-13505	1	Five-Terminal Terminal Strip—H. H. SMITH #1095 Used for mounting Resistors R15 and R16
		72-1606S	2	#6-32x3/8" Cross-Recessed Pan-Head Steel Machine Screw Used for attaching Terminal Strip TS3
		75-046	2	#6 Internal Tooth Steel Lock-Washer Used for attaching Terminal Strip TS3
		75-916S	2	#6-32 Standard Pattern Hex Nut Used for attaching Terminal Strip TS3
CR22	5F	31-1N4005	1	Silicon Diode—Type 1N4005 Mounted across coil terminals of Relay K22
	5	A020606-01	1	Relay Kit—Used on A006032-09 and -13 Power Supplies only Consists of Relay K22 and Diode CR22
	5G	43-4008	1	24VDC, 20Amp, SPST Relay— POTTER & BRUMFIELD #KR3DH-24V
		75-916S	1	#6 Standard Pattern Hex Nut Used for mounting Relay K22
	5H	31-1N4005	1	Silicon Diode—Type 1N4005 Mounted across coil terminals of Relay K22
R1	11	19-8C5W1P0	1	1 Ohm, ±5%, 50W, Wirewound Fixed Resistor— CLAROSTAT #VP50K-1
		72-1604S	2	#6-32x1/4" Cross-Recessed Pan-Head Steel Machine Screw Used for attaching Resistor R1
		75-057	2	#6 Internal Tooth Steel Lock-Washer Used for attaching Resistor R1
T1	6	006182-05	1	Main Power Transformer
		020434-01	2	Transformer Spacer Used for mounting Transformer T1
		75-5116N	4	#10-24x1" Round-Head Square-Neck Steel Carriage Bolt Used for attaching Transformer T1
		75-010S	4	#10 SAE Standard Steel Flat Washer Used for attaching Transformer T1



NOTE:
SEE OTHER SIDE FOR PARTS LIST

COIN DOOR
A009084-01 thru -12
A020635-01 thru -12

CABINET SUB-ASSEMBLY

ATARI®

Section C
Sheet 31

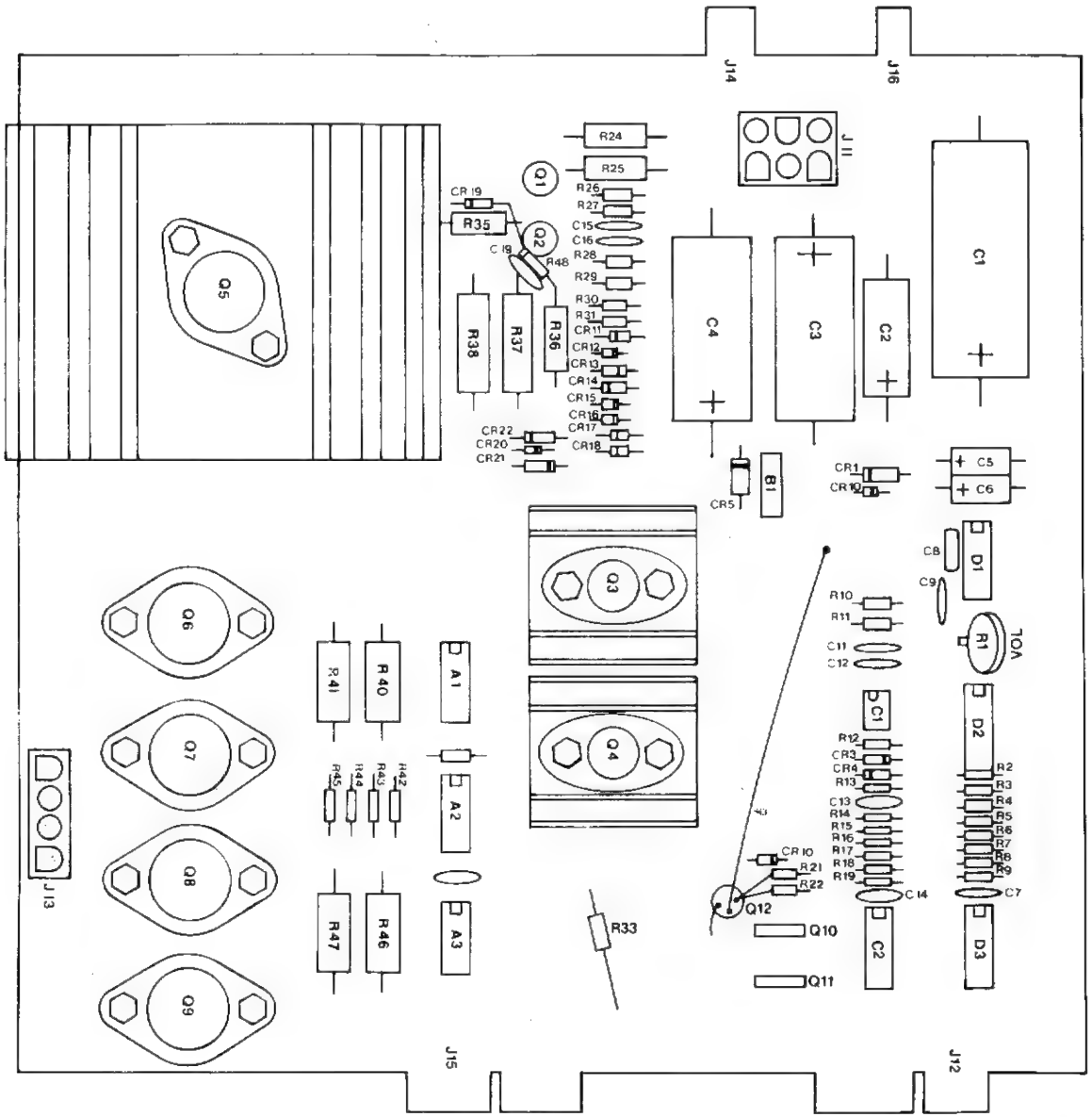
ITEM	PART NUMBER	QTY	DESCRIPTION
0	62-030	1	Subminiature Momentary-Contact Normally-Open SPST Switch — C&K #30-3 Switch identified with Test designation. Used only on Airborne Avenger Coin Door A020635-01 thru -07
	020386-01	1	Test Switch Bracket Used for mounting TEST switch
	A006794-01	1	Coin Door — Consists of items listed after A006794-12 Used only on 25-Cent Coin Door Assy A020635-01
	A006794-02	1	Coin Door — Consists of items listed after A006794-12 Used only on 5-Franc Coin Door Assy A020635-02
	A006794-03	1	Coin Door — Consists of items listed after A006794-12 Used only on 1-Deutschmark Coin Door Assy A020635-03
	A006794-04	1	Coin Door — Consists of items listed after A006794-12 Used only on 1 Krona Coin Door Assy A020635-04
	A006794-05	1	Coin Door — Consists of items listed after A006794-12 Used only on 100-Yen Coin Door Assy A020635
	A006794-06	1	Coin Door — Consists of items listed after A006794-12 Used only on 10-New Pence (1-Florin) Coin Door Assy A0020635-06
	A006794-07	1	Coin Door — Consists of items listed after A006794-12 Used only on Australian 20-Cent Door Assy A020635-07
	A006794-08	1	Coin Door — Consists of items listed after A006794 12 Used only on1/5-Deutschmark Coin Door Assy A020635-08
	A006794 09	1	Coin Door — Consists of items listed after A006794 12 Used only on 1-Franc Coin Door Assy A020635-09
	A006794-10	1	Coin Door — Consists of items listed after A006794-12 Used only on 1 Baht Coin Door Assy A020635-10
	A006794 11	1	Coin Door — Consists of items listed after A006794-12 Used only on 1/5-Deutschmark Coin Door A020635-11
	A006794-12	1	Coin Door — Consists of items listed after A006794-12 Used only on 100 Lira Coin Door Assy A020635-12
1	A007637-01	1	Front Bezel Assy — Consists of items 1A thru 1G Used only on 25-Cent Coin Door A006794-0
1	A007637-02	1	Front Bezel Assy — Consists of items 1A thru 1G Used only on 5-Franc Coin Door A006794-02
1	A007637-03	1	Front Bezel Assy — Consists of items 1A thru 1G Used only on 1-Deutschmark Coin Door A006794-03
1	A006737-04	1	Front Bezel Assy — Consists of items 1A thru 1G Used only on 1-Krona Coin Door A006794-04
1	A007637 05	1	Front Bezel Assy — Consists of items 1A thru 1G Used only on 100-Yen Coin Door A006794-05
1	A007637 06	1	Front Bezel Assy — Consists of items 1A thru 1G Used only on 10-New Pence (1-Florin) Coin Door A0067904-06
1	A007637-07	1	Front Bezel Assy — Consists of items 1A thru 1G Used only on Australian 20-Cent Coin Door A006794-07
1	A007637-08	1	Front Bezel Assy — Consists of items 1A thru 1G Used only on1/5-Deutschmark Coin Door A006794-08
1	A007637-09	1	Front Bezel Assy — Consists of items 1A thru 1G Used only on 1-Franc Coin Door A006794 09
1	A007637-10	1	Front Bezel Assy — Consists of items 1A thru 1G Used only on 1-Baht Coin Door A006794 10
1	A007637-11	1	Front Bezel Assy — Consists of items 1A thru 1G Used only on 1/5-Deutschmark Coin Door A006794-11
1	A007637-12	1	Front Bezel Assy — Consists of items 1A thru 1G Used only on 100-Lira Coin Door A006794-12
1A	004328-01	1	Bezel
	75-991401	6	Thread Cutting Nut PALNUT #SR188006 Used for attaching Bezel to Coin Door Weldment (item 6)
1B	004330-01	2	Ring Used only on Coin Door A007637 01, -02, and -04
1B	007752-01	1	Ring Used only on right side of Coin Door A007637-11
1B	007752-01	2	Ring Used only on Coin Door A007637-07
1B	009153-01	1	Ring Used only on left side of Coin Door A007637-08 and -11
1B	009153-01	2	Ring Used only on Coin Door A007637 03, -05, -09
1B	030677-01	2	Ring Used only on Coin Door A007637-06, -10, and 12
1B	030677-01	1	Ring Used only on right side of Coin Door A007637 08
1C	004331-01	2	Coin Shield Used only on Coin Door A007637 01 thru -05, -08, -09, and -11
1C	030248-01	2	Coin Shield Used only on Coin Door A007637-06, -07, -10 and -12
1D	004332-01	2	Primary Coin Chute
	75-9914001	6	Thread Cutting Nut — PALNUT #SR188006 Used for attaching Ring, Coin Shield, and Primary Coin Chute to Bezel
1E	004327-01	2	Scavenger Button Bearing
	73-3009	2	Retaining Ring for Shaft Diameter of 0.375" — TRUARC #5103-37 Used for attaching Scavenger Button Bearing to Bezel

ITEM	PART NUMBER	QTY	DESCRIPTION
1F	004343-01	1	25-Cent Price Plate
1F	004343-06	1	5-Franc Price Plate
1F	004343-04	1	1-Deutschmark Price Plate
1F	004343-03	1	1-Krona Price Plate
1F	004343-05	1	100-Yen Price Plate
1F	004343-02	1	10-New Pence (1-Florin) Price Plate
1F	004343-07	1	Australian 20-Cent Price Plate
1F	004343-08	1	½" - Deutschmark Price Plate
1F	004343-09	1	1 - Franc Price Plate
1F	004343-10	1	1-Baht Price Plate
1F	004343-11	1	1/5 - Deutschmark Price Plate
1F	004343-12	1	100 - Lira Price Plate
1G	04329 01	2	Price Plate Clamp Used for attaching Price Plate to the Bezel
	75-046	2	#6 Cadmium-Plated Split-Lock Washer
	72-1604s	2	#6-32x1/4" Cross-Recessed Pan-Head Steel Machine Screw Used for attaching bottom Price Plate Clamp to Bezel. Top Price Plate Clamp is attached to bezel with screw fed thru Test Switch Bracket (item 0) and Anti-Probe Plate (item 25).
3	A007639-01	1	Coin Lock-Out Assy
	75-946C	2	#6-32 POLYMER Self-Locking Hex Nut Used for attaching Key Loop and Coin Lock-Out Assy to Coin Door Weldment studs
4	A007640 01	2	Coin Switch Assy — Consists of items 4A thru 4C. Please note mounting position method of eliminating "Free game for punching coin door
4A	004342-01	1	Switch Mounting Plate
	75-946C	2	Locknut #6 32 used to hold Switch Mounting Plate on studs from Secondary Coin Chute item 7
4B	65-071C	1	Miniature Switch — Cherry #E51-60B
	72-HA4412	2	#4-40x5/8"
4C	008824-0I	1	Wireform
5	A002465-0I	1	Coin Counter Assy — Consists of items 5A thru 5C
5A	47-1002	1	
5B	79-58027	1	3-Circuit Plug Shell Molex #03-09-1031
5C	79-20115	2	Connector Terminal Contact — Molex #02-09-2118
	75-946C	4	Locknut #6-32 Used for attaching Coin Counter Assy to Coin Door Weldment studs.
6	004320-0I	1	Coin Door Weldment
7	004341-01	2	Secondary Coin Chute
8	004344-01	1	Key Loop
9	004340-01	2	Return Spring
	75-946C	2	Locknut #6-32 Used for attaching Spring to Weldment Studs
10	004337-01	2	Bracket, Wire Form
	75-946C	4	Locknut #6-32 Used for attaching Bracket to Weldment Studs
	004338-01	1	Lockout Wireform, Right Hand
12	004336-01	1	Lockout Wireform, Left Hand
13	004326-01	2	Scavenger Button
	73-3008	2	'C' Ring Spacer Used to hold Scavenger Button
15	006904-01	2	
16	007359-01	1	Lamp Socket
	70-11-47	1	Lamp
	75-946C	1	Locknut #6-32 Used for attaching Lamp Socket to Weldment Stud
	008629-01	2	Return Spring Used to hold Coin Mech in place
23	71-2118	1	Lock Assembly, Hudson
24	71-1225CU	2	Coin Mech 25-Cents for A006794-01
24	71-125FB	2	Coin Mech 5-Franc for A006794-02
24	71-121MG	2	Coin Mech 1 Deutschmark for A006794-03
24	71-121KS	2	Coin Mech 1 Krona for A006794-04
24	71-12100YJ	2	Coin Mech 100 Yen for A006794-05
24	71-1210PE	2	Coin Mech 10-New Pence (1-Florin) for A006794-06
24	71-1220CA	2	Coin Mech Australian 20 Cent for A006794-07
25	007753-0I	1	Anti-Probe Plate
26	A007638-01	1	Slam Switch Assy
	75-946C	2	Locknut #6-32 Used to hold Slam Switch Assy to Weldment Stud

ATARI®

CABINET SUB-ASSEMBLY

COIN DOOR
A009084-01 thru -12
A020635-01 thru -12



Auxiliary PCB
A006407-01

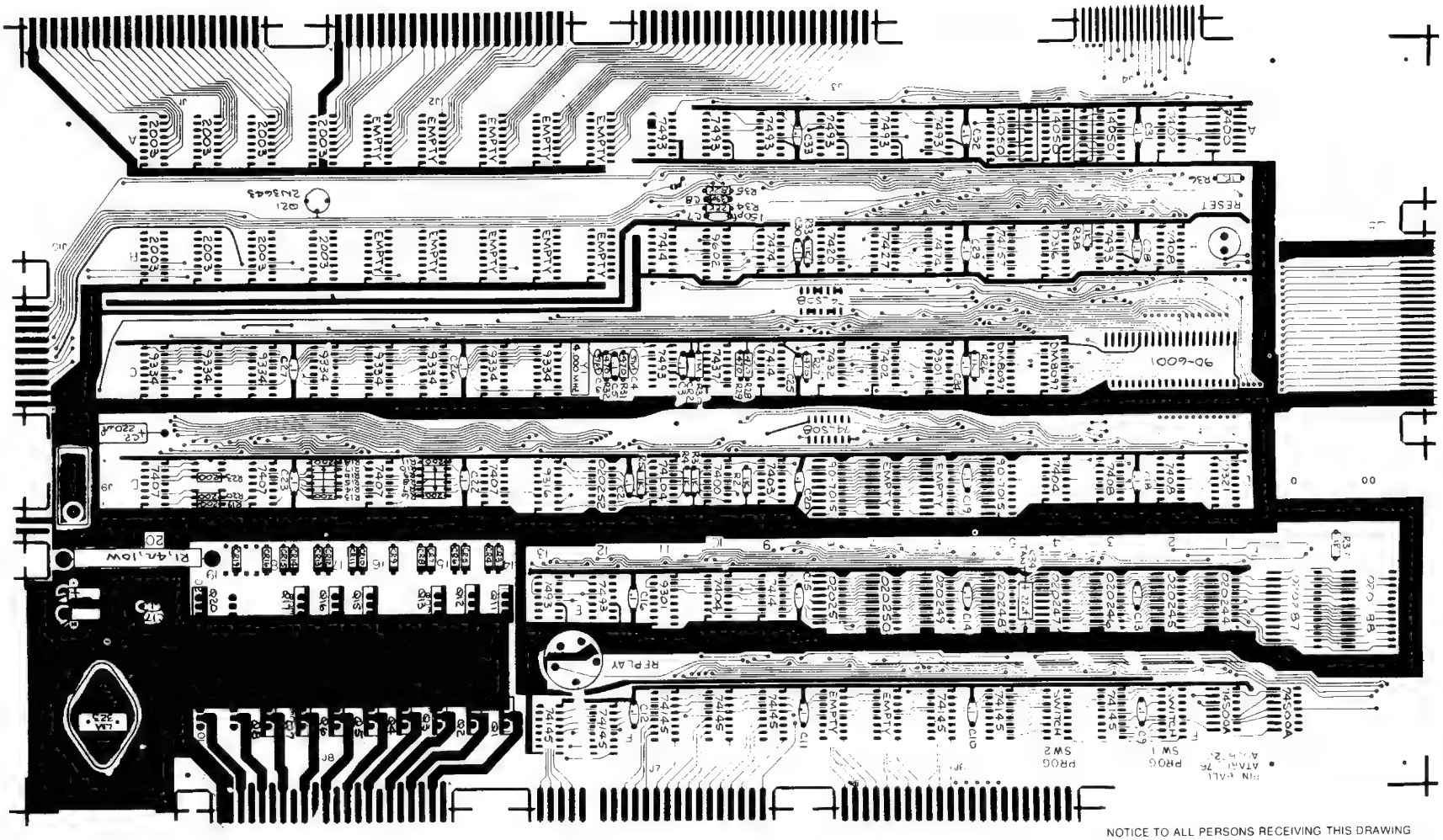
CABINET SUB-ASSEMBLY

ATARI®

DESIG-NATION	LOCA-TION	ITEM	PART NUMBER	DESCRIPTION
C1		18	24-250478	4700μf, +50%, −10%, 25WVDC Electrolytic Capacitor
C2		19	24-250477	470μf, +50%, −10%, 25WVDC Electrolytic Capacitor
C3, C4		16	24-151506	50μf, +50%, −10%, 150WVDC Electrolytic Capacitor
C5		17	24-250106	10μf, +50%, −10%, 25WVDC Electrolytic Capacitor
C6		20	24-350105	1.0μf, +50%, −10%, 25WVDC Electrolytic Capacitor
C7		21	27-250104	0.1μf, −20%, 25V Disc Ceramic Capacitor
C8		23	28-101101	100μμf, ±5%, 100V Mica Capacitor
C9–C14		21	27-250104	0.1μf, −20%, 25V Disc Ceramic Capacitor
C15, C16		22	27-250103	0.01μf, ±20%, 25V Disc Ceramic Capacitor
C18, C19		21	27-250104	0.1μf, −20%, 25V Disc Ceramic Capacitor
CR1		55	32-1N5335	3.9V Zener Diode—Type 1N5335
CR3, CR4		28	32-1N5235	6.8V Zener Diode—Type 1N5235
CR5		27	32-P6KE30	Transient Suppressor Diode
CR10–CR12		26	31-1N4005	General Purpose Rectifier—Type 1N4005
CR13–CR14		30	32-1N4763A	91V Zener Diode—Type 1N4763A
CR15–CR18		26	32-1N4005	General Purpose Rectifier—Type 1N4005
CR19		29	32-1N5242B	12V Zener Diode—Type 1N5242B
CR20		25	31-1N914	General Purpose Signal Diode—Type 1N914
CR21		56	32-1N5230	4.7V Zener Diode—Type 1N5230
CR22		26	32-1N4005	General Purpose Rectifier—Type 1N4005
J11		52	79-58123	4-Pin Header—Amphenol P.N. 350431-1
J13		53	79-58124	6-Pin Header—Amphenol P.N. 350761-4
Q1		33	34-2N3643	Silicon NPN Tuned RF Power Amplifier—Type 2N3643
Q2		31	33-2N3644	Silicon PNP General Purpose Amplifier—Type 2N3644
Q3		34	34-2N3583	Silicon NPN General Purpose Amplifier—Type 2N3583
Q4		37	33-2N6420	Silicon PNP General Purpose Amplifier—Type 2N6420
			72-1408C	#4-40x1/2" Phillips Pan-Head Stainless Steel Machine Screw Quantity of four used for mounting transistors Q3 and Q4
			75-014S	#4 Flat Steel Washer Quantity of four used for mounting transistors Q3 and Q4
			75-054S	#4 Internal Tooth Steel Lock Washer Quantity of four used for mounting transistors Q3 and Q4
			75-914C	#4-40 Hexagonal Stainless Steel Nut Quantity of four used for mounting transistors Q3 and Q4
			75-09012T	Teflon Shoulder Washer—Seastrom P.N. 5608-69 Quantity of four used for mounting transistors Q3 and Q4
			78-0A01	Nylon Transistor Insulating Cover—Size TO-66 Quantity of two used for covering transistors Q3 and Q4
			78-16011	Thermally Conductive Insulator—Size TO-66 Quantity of two used for mounting transistors Q3 and Q4
			78-06002	Heatsink—Thermalloy P.N. 6111B-66 Quantity of two used for mounting transistors Q3 and Q4

DESIG-NATION	LOCA-TION	ITEM	PART NUMBER	DESCRIPTION
Q5		36	34-2N6282	Darlington Silicon NPN Power Transistor — Type 2N6282
			72-1608C	#6-32x⅜" Phillips Pan-Head Stainless Steel Screw Quantity of two used for mounting transistor Q5
			75-016S	#6 Flat Steel Washer Quantity of two used for mounting transistor Q5
			75-056S	#6 Internal Tooth Steel Lock Washer Quantity of two used for mounting transistor Q5
			75-916C	#6-32 Hexagonal Steel Nut Quantity of two used for mounting transistor Q5
			75-090*5	Teflon Shoulder Washer - Seastrom P.N. 5605-25 Quantity of two used for mounting transistor Q5
			78-06012	Modified Heatsink—Wakefield P.N. 641-V Used for mounting transistor Q5
Q6–Q9		32	33-2N5883	Silicon PNP General Purpose Amplifier Type 2N5883
			72-1608C	#6-32x⅜" Phillips Pan-Head Stainless Steel Screw Quantity of eight used for mounting transistors Q6–Q9
			75-016S	#6 Flat Steel Washer Quantity of eight used for mounting transistors Q6–Q9
			75-056S	#6 Internal Tooth Steel Lock Washer Quantity of eight used for mounting transistors Q6–Q9
			75-916C	#6-32 Hexagonal Stainless Steel Nut Quantity of eight used for mounting transistors Q6–Q9
R1		15	19-311502	5000 ohm Linear Vertical PC Mounting Carbon Trimpot
R2		4	10-5183	18k ohm, ±5%, ¼W Carbon Composition Resistor
R3		8	10-5683	68k ohm, ±5%, ¼W Carbon Composition Resistor
R4		9	10-5822	8.2k ohm, ±5%, ¼W Carbon Composition Resistor
R5		7	10-5333	33k ohm, ±5%, ¼W Carbon Composition Resistor
R6–R9		9	10-5822	8.2k ohm, ±5%, ¼W Carbon Composition Resistor
R10		5	10-52P7	2.7 ohm, ±5%, ¼W Carbon Composition Resistor
R11		57	10-5101	100 ohm, ±5%, ¼W Carbon Composition Resistor
R12		7	10-5333	33k ohm, ±5%, ¼W Carbon Composition Resistor
R13		9	10-8522	8.2k ohm, ±5%, ¼W Carbon Composition Resistor
R14		3	10-5152	1.5k ohm, ±5%, ¼W Carbon Composition Resistor
R15		2	10-5122	1.2k ohm, ±5%, ¼W Carbon Composition Resistor
R16		8	10-5683	68k ohm, ±5%, ¼W Carbon Composition Resistor
R17		7	10-5333	33k ohm, ±5%, ¼W Carbon Composition Resistor
R18		4	10-5183	18k ohm, ±5%, ¼W Carbon Composition Resistor
R19		9	10-5822	8.2k ohm, ±5%, ¼W Carbon Composition Resistor
R21, R22		69	10-5201	200 ohm, ±5%, ¼W Carbon Composition Resistor
R24, R25		11	12-5153	15k ohm, ±5%, 1W Carbon Composition Resistor
R26, R27		6	10-5331	330 ohm, ±5%, ¼W Carbon Composition Resistor
R28, R29		10	11-5220	22 ohm, ±5%, ½W Carbon Composition Resistor
R30, R31		8	10-5683	68k ohm, ±5%, ¼W Carbon Composition Resistor
R33		67	10-5221	220 ohm, ±5%, ¼W Carbon Composition Resistor
R35		45	11-5391	390 ohm, ±5%, ½W Carbon Composition Resistor
R36		50	12-5103	10k ohm, ±5%, 1W Carbon Composition Resistor
R37, R38		13	16-5752	7.5k ohm, ±5%, 5W Carbon Composition Resistor
R39		6	10-5331	330 ohm, ±5%, ¼W Carbon Composition Resistor

DESIG-NATION	LOCA-TION	ITEM	PART NUMBER	DESCRIPTION
R40, R41			13-5390	39 ohm, ±5%, 2W Carbon Composition Resistor
R42–R45			10-5822	8.2k ohm, ±5%, ¼W Carbon Composition Resistor
R46, R47			13-5390	39 ohm, ±5%, ¼W Carbon Composition Resistor
R48			10-5204	200k ohm, ±5%, ¼W Carbon Composition Resistor
	A1	39	37-MC1413	Darlington NPN Transistor Array—Type MC1413
	A2, A3	42	37-7402	Quad 2-Input NOR Gate—Type 7402
	B1	24	3A-MDA100A	Full-Wave Bridge Rectifier Network
	C1	40	37-741	General Purpose Operational Amplifier — Type μA741
	C2	43	37-7407	Hex Buffer/Driver—Type 7407
	D1	38	37-LM380	Audio Power Amplifier—Type LM380
	D2	41	37-4016	Quad Bilateral Switch—Type CD4016AE
	D3	43	37-7407	Hex Buffer/Driver—Type 7407



PROCESSOR PCB
A006020-17, and -18

CABINET SUB-ASSEMBLY

ATARI®

ATARI®

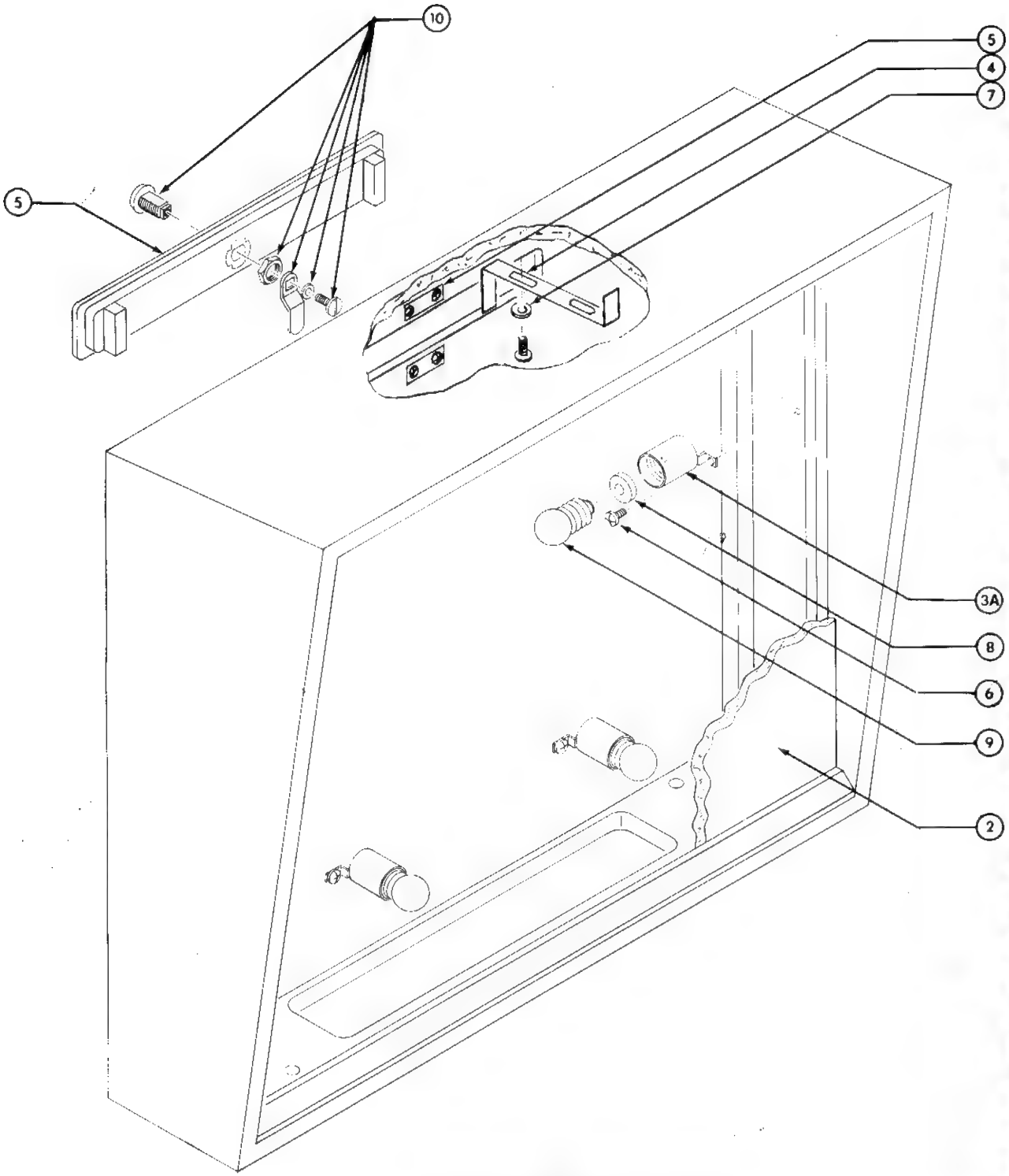
CABINET SUB-ASSEMBLY

PROCESSOR PCB
A006020-17, and -18

DESIG-NATION	LOCA-TION	ITEM	PART NUMBER	DESCRIPTION
C1		16	29-006	1μf, ±10%, 35V Electrolytic Tantalum Capacitor
C2		12	24-250227	220μf, +50%, −10%, 25V Axial Lead Fixed Electrolytic Capacitor
C3		13	27-250104	0.1μf, ±20%, 25V Disc Ceramic Capacitor
C4		14	28-101390	39μμf, ±5%, 100V Radial Lead Dipped Mica Capacitor
C5		13	27-250104	0.1μf, ±20%, 25V Disc Ceramic Capacitor
C6		14	28-101390	39μμf, ±5%, 100V Radial Lead Dipped Mica Capacitor
C7		15	28-101151	150μμf, ±5%, 100V Radial Lead Dipped Mica Capacitor
C8		14	28-101390	39μμf, ±5%, 100V Radial Lead Dipped Mica Capacitor
C9–C33		13	27-250104	0.1μf, ±20%, 25V Disc Ceramic Capacitor
C34		17	29-007	22μf, ±10%, 15V Electrolytic Tantalum Capacitor
CR1		20	32-P6KE18	Transient Suppressor Diode General Semiconductor Industries P.N. P6KE18
CR2–CR7 CR10-CR13 CR14,CR16 CR19		19	31-1N914	General Purpose Silicone Signal Diode—Type 1N914
J9		63	79-58122	4-Pin Header
LM323		46	37-LM323	Voltage Regulator—Type LM323
		54	72-1608S	#6-32x½" Phillips Pan-Head Steel Machine Screw Quantity of two used for mounting Regulator LM323
		55	75-016S	#6 Flat Steel Washer Quantity of two used for mounting Regulator LM323
		56	75-056S	#6 Internal Tooth Steel Lock Washer Quantity of two used for mounting Regulator LM323
		57	75-916S	#6-32 Hexagonal Cadmium-Plated Nut Quantity of two used for mounting Regulator LM323
		58	78-06001	Heatsink—Wakefield P.N. 690 Used for mounting Regulator LM323
		59	78-16005	Thermally Conductive Insulator for size TO-3 Used for mounting Regulator LM323
Q1,Q2,Q5 Q6,Q8,Q11-Q13 Q15-Q17, Q20		21	34-2N6044	Darlington Silicone NPN Transistor—Type 2N6044
Q21		22	34-2N3643	Silicone NPN Transistor—Type 2N3643
R1		10	19-808W4PO	4 ohm, ±20%, 10W Special Wirewound Resistor
R2–R5		4	10-5102	1k ohm, ±5%, ¼W Carbon Composition Resistor
R6,R8-11 R13-R17, R20 R23		2	10-5201	200 ohm, ±5%, ¼W Carbon Composition Resistor
R26		4	10-5102	1k ohm, ±5%, ¼W Carbon Composition Resistor
R27–R29		3	10-5417	470 ohm, ±5%, ¼W Carbon Composition Resistor
R30		7	10-5105	1M ohm, ±5%, ¼W Carbon Composition Resistor
R31, R32		3	10-5417	470 ohm, ±5%, ¼W Carbon Composition Resistor
R33		4	10-5102	1k ohm, ±5%, ¼W Carbon Composition Resistor
R34		6	10-5223	22k ohm, ±5%, ¼W Carbon Composition Resistor
R35		5	10-5822	8.2k ohm, ±5%, ¼W Carbon Composition Resistor
R36-R42 R37, R38		4	10-5102	1k ohm, ±5%, ¼W Carbon Composition Resistor
	A1	23	37-7400	Quad 2-Input NAND Gate—Type 7400
	A2	24	37-7402	Quad 2-Input NOR Gate—Type 7402
	A3/A4, A4/A4	9	19-007	10K ohm Resistor Network—CTS #750-81-R10K
	A3–A5	48	37-MC14050	Hex Buffer—Type MC14050

DESIG-NATION	LOCA-TION	ITEM	PART NUMBER	DESCRIPTION
	A6–A11	37	37-7493	4-Bit Binary Counter—Type 7493
	A16–A20	47	37-MC1413	Darlington NPN Transistor Array—Type MC1413
	B2	29	37-7408	Quad 2-Input AND Gate—Type 7408
	B3	37	37-7493	4-Bit Binary Counter—Type 7493
	B4	42	37-9316	4-Bit Binary Counter—Type 9316
	B5	39	37-74157	Quad 2-Input Multiplexer—Type 74157
	B6	36	37-7474	Dual D Flip-Flop—Type 7474
	B7	33	37-7427	Triple 3-Input NOR Gate—Type 7427
	B8	32	37-7420	Dual 4-Input NAND Gate—Type 7420
	B9	36	37-7474	Dual D Flip-Flop—Type 7474
	B10	45	37-9602	Dual One-Shot Multivibrator—Type 9602
	B11	31	37-7414	Hex Schmitt Trigger—Type 7414
	B16–B20	47	37-MC1413	Darlington NPN Transistor Array—Type MC1413
	B/C8	30	37-74LS08	Quad 2-Input AND Gate—Type 74LS08
	C1	65	90-6001	Microprocessor—Type MC6800L
	C1	62	79-42040	Medium Insertion 40 Position Socket
	C4, C5	40	37-8097	Tri-State Hex Buffer—Type 8T97
	C6	41	37-9301	1-of-10 Decoder—Type 9301
	C7	24	37-7402	Quad 2-Input NOR Gate—Type 7402
	C8	34	37-7432	Quad 2-Input OR Gate—Type 7432
	C9	31	37-7414	Hex Schmitt Trigger—Type 7414
	C10	35	37-7437	Quad 2-Input NAND Buffer—Type 7437
	C11	37	37-7493	4-Bit Binary Counter—Type 7493
	C13–C20	44	37-9334	8-Bit Addressable Latch—Type 9334
	C/D8	30	37-74LS08	Quad 2-Input AND Gate—Type 74LS08
	D1	43	37-9321	Dual 1-of-4 Decoder—Type 9321
	D2, D3	29	37-7408	Quad 2-Input AND Gate—Type 7408
	D4	26	37-7404	Hex Inverter—Type 7404
	D5, D8	66	90-7015	Random Access Memory—Type 2111A
	D9	25	37-7403	Quad 2-Input NAND Gate (open collector)—Type 7403
	D10	23	37-7400	Quad 2-Input NAND Gate—Type 7400
	D11	27	37-74L04	Hex Inverter—Type 74L04
	D12	77	020252-01	Audio Read-Only-Memory
	D13	42	37-9316	4-Bit Binary Counter—Type 9316
	D14, D16, D18, D20	28	37-7407	Hex Buffer/Driver—Type 7407
PROGRAM MEMORY FOR PROCESSOR PCB A006020-17 ONLY				
	E00	79	020965-01	020288-01
	E0	78	020966-01	020287-01
PROGRAM MEMORY FOR PROCESSOR PCB A006020-18 ONLY				
	E1	69	020957-01	Read-Only Memory—Address 7000-73FF, Bits 0–3
	E2	71	020958-01	Read-Only Memory—Address 7400-77FF, Bits 0–3
	E3	75	020960-01	Read-Only Memory—Address 7B00-7FFF, Bits 0–3
	E4	73	020959-01	Read-Only Memory—Address 7800-7AFF, Bits 0–3
	E5	74	020963-01	Read-Only Memory—Address 7800-7AFF, Bits 4–7
	E6	76	020960-01	Read-Only Memory—Address 7B00-7FFF, Bits 4–7
	E7	70	020961-01	Read-Only Memory—Address 7000-73FF, Bits 4–7
	E8	72	020962-01	Read-Only Memory—Address 7400-77FF, Bits 4–7

DESIG-NATION	LOCA-TION	ITEM	PART NUMBER	DESCRIPTION
	E9	31	37-7414	Hex Schmitt Trigger—Type 7414
	E10	26	37-7404	Hex Inverter—Type 7404
	E11	41	37-9301	1-of-10 Decoder—Type 9301
	E12, E13	37	37-7493	Binary Counter—Type 7493
	F0, F1	80	37-74S00	Quad 2-Input NAND Gate—Type 74S00
	F2	52	66-118PIT	8 Position Dual-Inline-Package Switch—PROG SW1
	F3	38	37-74145	1-of-10 Decoder/Driver—Type 74145
	F4	52	66-118PIT	8 Position Dual-Inline-Package Switch—PROG SW2
	F5, F6, F9–F13	38	37-74145	1-of-10 Decoder/Driver—Type 74145
	REPLAY	53	66-12FPIT	Hex Switch
	RESET	51	62-001	SPST Pushbutton Switch
	Y1	64	90-108	4.000 MHz Crystal



ATARI

BACK BOX ASSEMBLY

THE ATARIANS
SPACE RIDERS
TIME 2000
AIRBORNE AVENGER
MIDDLE EARTH

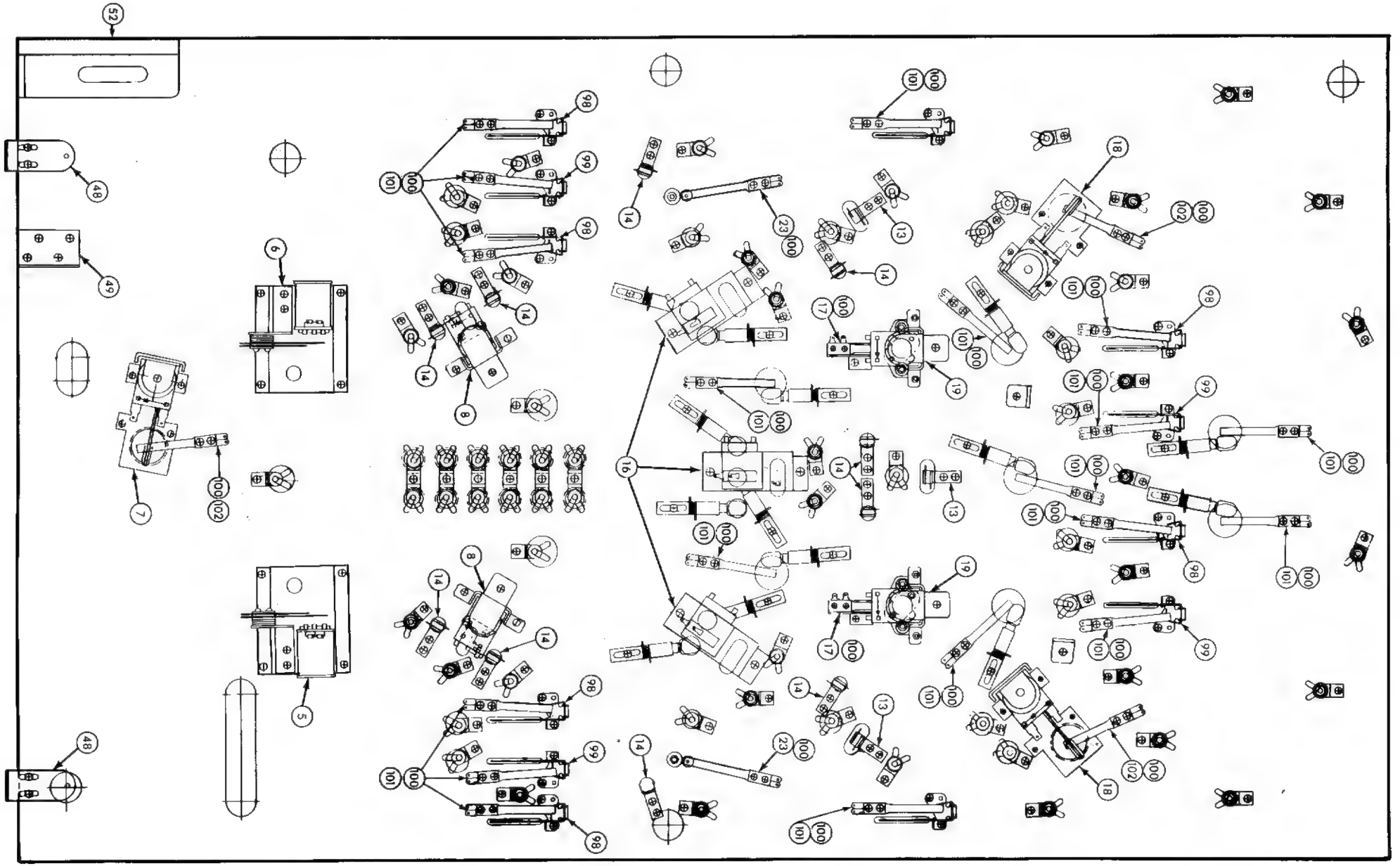
A006986-01 thru -04 and -06

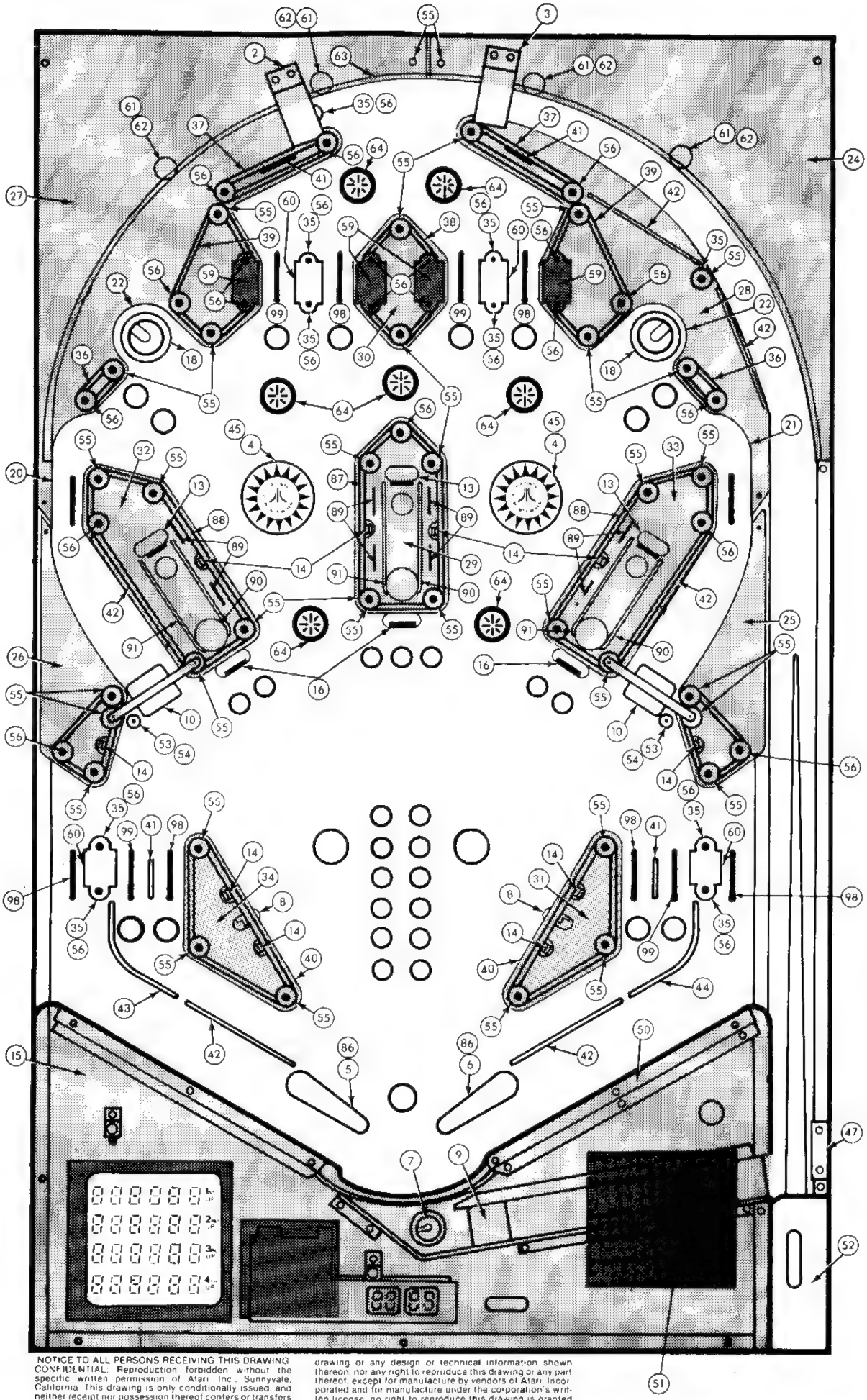
ITEM	PART NUMBER	QTY	DESCRIPTION	FOR MORE INFORMATION
2	A007845-01	1	Back Glass Assembly Used on The Atarians only	
	A007845-02	1	Back Glass Assembly Used on Time 2000 only	
	A007845-03	1	Back Glass Assembly Used on Airborne Avenger only	
	A007845-04	1	Back Glass Assembly Used on Middle Earth only	
	A007845-06	1	Back Glass Assembly Used on Space Riders only	
3	A007867-01	1	Back Box Harness Assembly Not identified on drawing	
3A		5	Medium Screw Base Standard AC Utility Lamp Base—Part of Box Harness Assembly A007867-01	
4	006019-01	2	Glass Retainer	
5	006036-01	2	Lock Base Plate	
6	72-6808C	8	#8x½" Cross-Recessed Type AB Pan-Head Thread-Forming Steel Screw	
7	75-048	6	#8 Regular Pattern Standard Plain Flat Steel Washer	
8	43-71600121	3	120V, 60W, Lamp Flasher Thermal Relay	
9	70-1617P5	5	105V, 7½W, Medium Screw Base Standard AC Utility Soft-White Incandescent Lamp	
10	71-2117	1	Panel Cartridge Lock Hudson #CR73A569	

A020894-01

PLAYFIELD ASSEMBLY
SPACE RIDERS

ATARI





PLAYFIELD ASSEMBLY

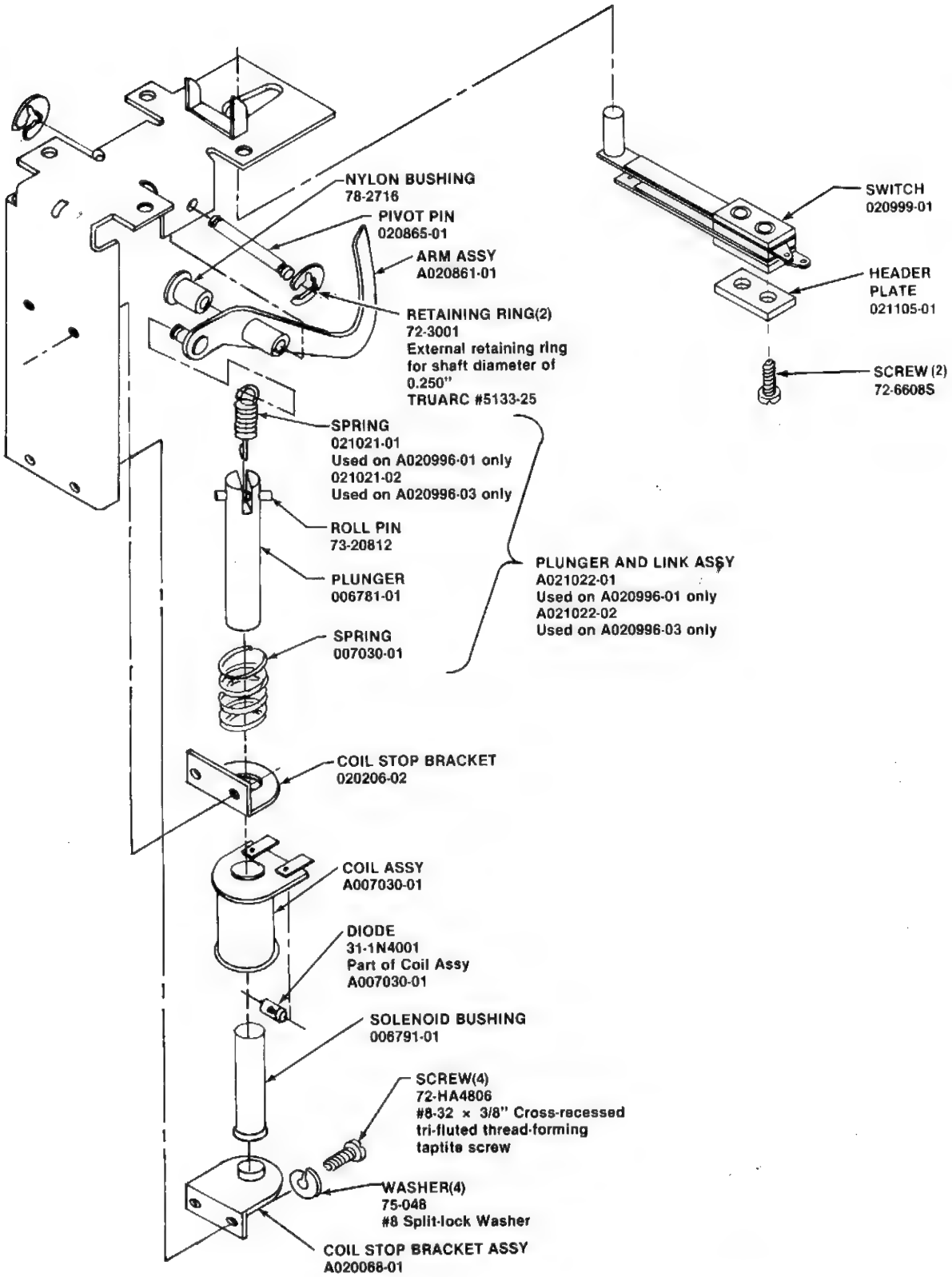
SPACE RIDERS

A020894-01

Section F
Sheet 5

Item	Part Number	Qty	Description	For More Information
2	A005019-01	1	BALL GATE	See Section G, Sheet 76
3	A020888-01	1	BALL GATE	See Section G, Sheet 76
4	A020115-01	2	THUMPER BUMPER BODY ASSY	See Section G, Sheet 27
5	A020968-01	1	LEFT LINEAR SINGLE FLIPPER	See Section G, Sheet 35
6	A020968-02	1	RIGHT LINEAR SINGLE FLIPPER	See Section G, Sheet 35
7	A020996-01	1	OUTHOLE KICKER	See Section G, Sheet 6
8	A006074-01	2	SLINGSHOT KICKER	See Section G, Sheet 12
9	A007833-01	1	BALL RETURN RAMP	See Section G, Sheet 97
10	A020986-01	2	SPINNING TARGET ASSY	See Section G, Sheet 47
11				
12				
13	A020982-09	3	TARGET SWITCH	See Section G, Sheet 49
14	A021000-01	10	SWITCH AND BRACKET	See Section G, Sheet 65
15	A021001-01	1	LOWER ARCH BUTYRATE	
16	A020201-03	3	DROP TARGET	See Section G, Sheet 48
17	A020970-01	2	THUMPER BUMPER SWITCH	See Section G, Sheet 27
18	A020996-03	2	HOLE KICKER	See Section G, Sheet 6
19	A007033-01	2	THUMPER BUMPER COIL AND BRACKET ASSY	See Section G, Sheet 27
20	A020562-01	1	LEFT BALL GUIDE	
21	A020562-02	1	RIGHT BALL GUIDE	
22	A020126-02	2	BALL DEFLECTOR	
23	020969-01	2	SPINNING TARGET SWITCH	See Section G, Sheet 47
24	020984-01	1	RIGHT UPPER ARCH BUTYRATE	
25	020984-02	1	RIGHT SPINNING TARGET BUTYRATE	
26	020984-03	1	LEFT SPINNING TARGET BUTYRATE	
27	020984-04	1	LEFT UPPER ARCH BUTYRATE	
28	020984-05	1	RIGHT HOLE KICKER BUTYRATE	
29	020984-06	1	CENTER CAPTURED BALL BUTYRATE	
30	020984-07	1	CENTER LANE BUTYRATE	
31	020984-08	1	RIGHT SLINGSHOT KICKER BUTYRATE	
32	020984-09	1	LEFT CAPTURED BALL BUTYRATE	
33	020984-10	1	RIGHT CAPTURED BALL BUTYRATE	
34	020984-11	1	LEFT SLINGSHOT KICKER BUTYRATE	
35	006127-01	10	5/16" (DIA.) RUBBER RING	
36	006127-04	2	¾"(DIA.) RUBBER RING	
37	006127-07	4	1½" (DIA.) RUBBER RING	
38	006127-08	1	2" (DIA.) RUBBER RING	
39	006127-09	2	2½" (DIA.) RUBBER RING	
40	006127-10	2	3" (DIA.) RUBBER RING	
41	004947-07	2	WIRE FORM	
42	004947-02	2	WIRE FORM	
43	020424-01	1	WIRE FORM	
44	020424-02	1	WIRE FORM	
45	020997-10	2	THUMPER BUMPER CAP	
47	007812-01	1	BALL RETURN SHIELD	
48	005952-01	2	PLAYFIELD INDEX PLATE	
49	005955-01	1	PLAYFIELD LOCKING BRACKET	
50	006749-01	1	LOWER ARCH TOP SUPPORT BRACKET	
51	006752-01	1	LOWER ARCH BOTTOM BALL GUIDE	
52	006772-01	1	BALL SHOOTER COVER	
53	020636-01	2	MINI POST	
54	99-080006	2	MINI POST RUBBER	
55	005985-01	36	WHITE LONG POST	
56	004985-01	29	WHITE SHORT POST	
59	004986-09	4	WHITE BALL GUIDE	
60	004987-09	4	WHITE BALL GUIDE	
61	020236-01	4	RAIL CLAMP BASE	
62	020237-01	4	RAIL CLAMP CAP	
63	020238-01	1	RAIL	
64	020040-30	7	STAR ROLLOVER ACTUATOR (BLACK)	

Item	Part Number	Qty	Description	For More Information
83	70-11-47	84	MINIATURE LAMP, NEMA #7	
86	006040-09	2	FLIPPER RUBBER RING	
87	006127-12	1	4" RUBBER RING	
88	006127-13	2	4½" RUBBER RING	
89	004947-08	8	WIRE FORM	
90	020720-01	3	WIRE FORM	
91	020720-02	3	WIRE FORM	
98	A020975-01	8	LANE ROLLOVER ACTUATOR	See Section G, Sheet 88
99	A020975-02	4	LANE ROLLOVER ACTUATOR	See Section G, Sheet 88
100	60-06002	24	HEADER PLATE	
101	020953-01	19	ROLLOVER SWITCH	See Section G. Sheet 88
102		3	HOLE KICKER SWITCH	See Section G, Sheet 6
107	A020732-01	1	Score Display	See Section C, Sheet 96C



ATARI®

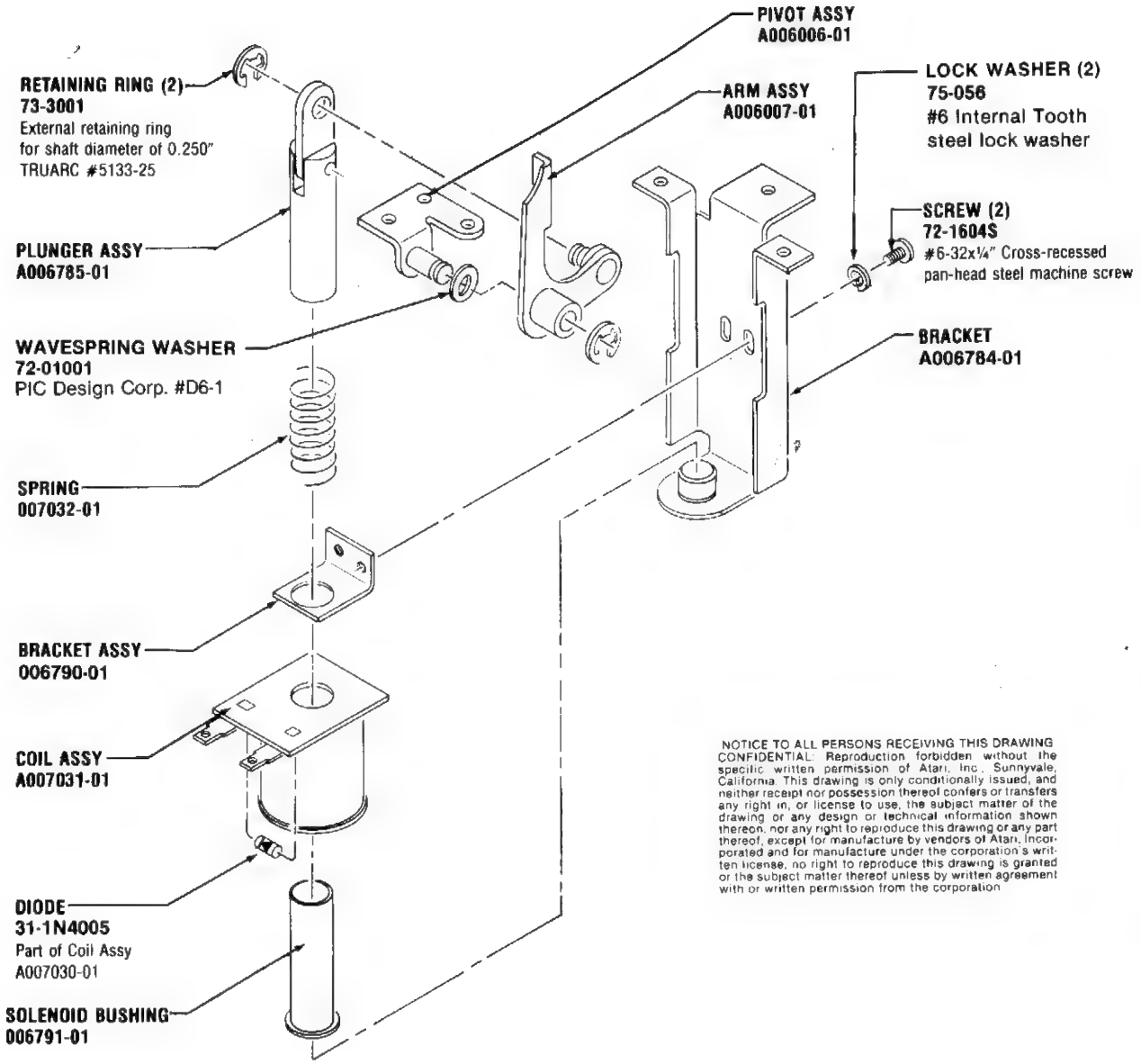
PLAYFIELD SUB-ASSEMBLY

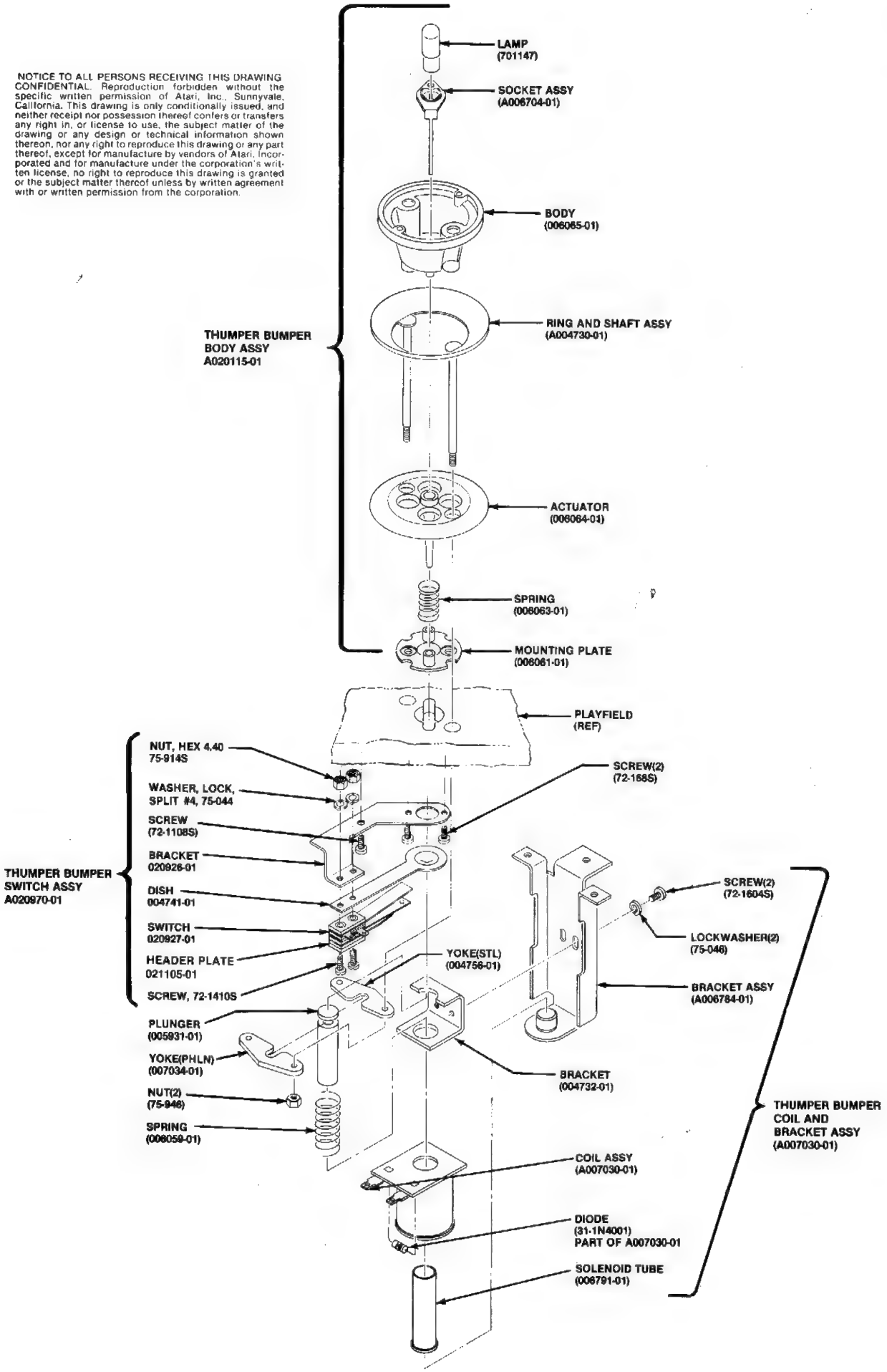
OUTHOLE AND HOLE KICKER

ATARI®

PLAYFIELD SUB-ASSEMBLY

SLINGSHOT KICKER
A006074-01



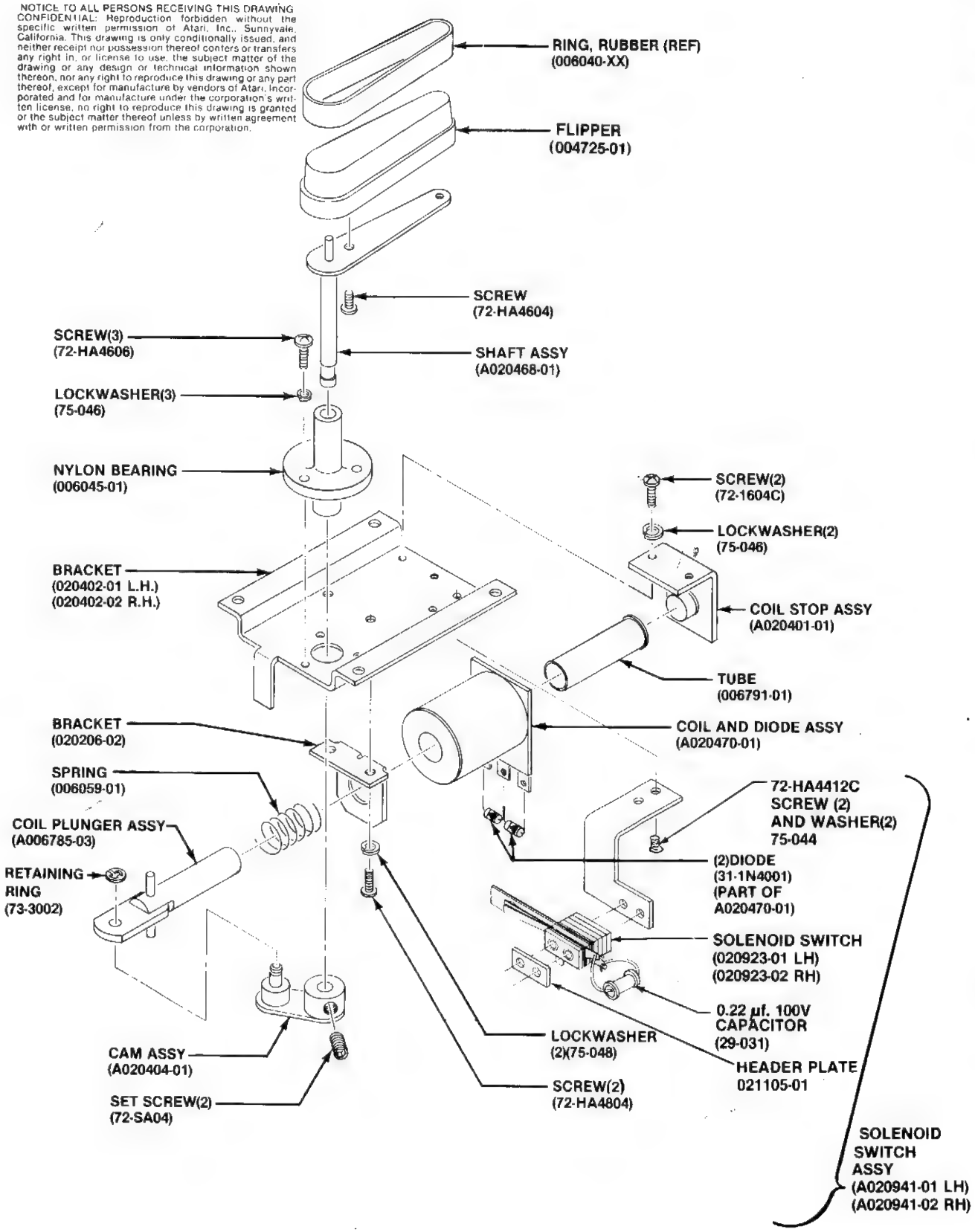


ATARI®

PLAYFIELD SUB-ASSEMBLY

THUMPER BUMPER

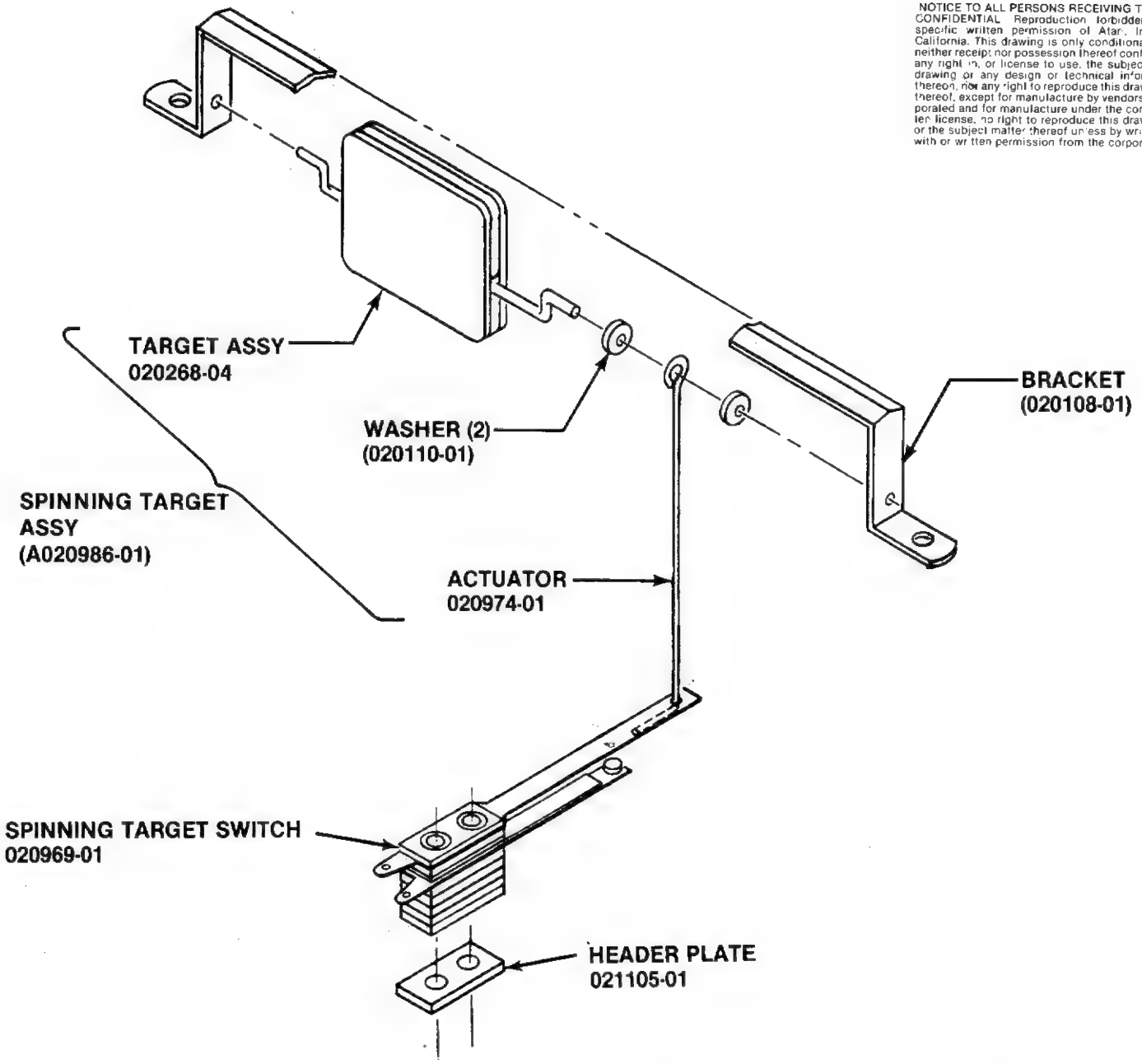
Section G
Sheet 27

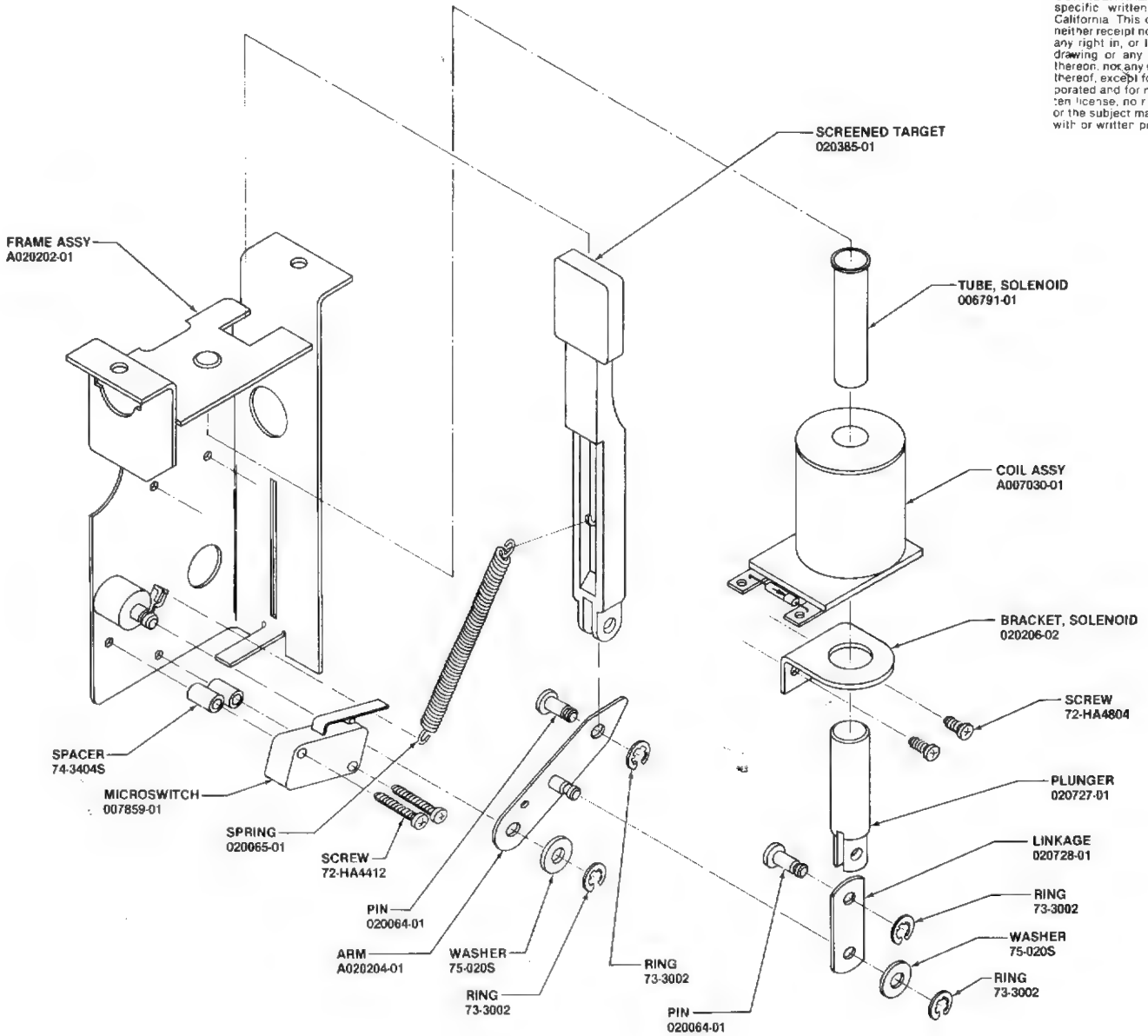


ATARI®

PLAYFIELD SUB-ASSEMBLY

LINEAR FLIPPER
A020968-01 and -02

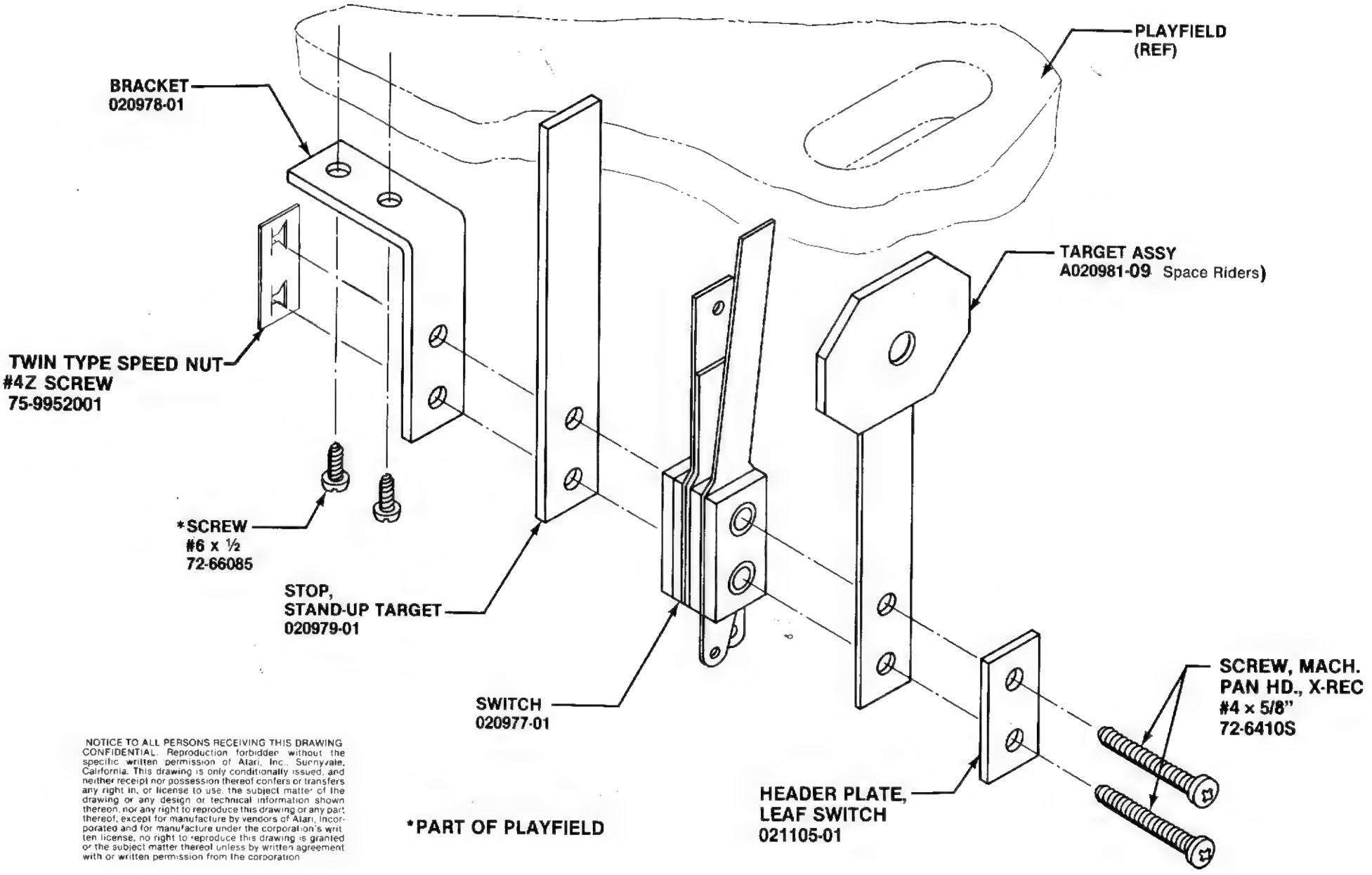




DROP TARGET
A020201-03

PLAYFIELD SUB-ASSEMBLY

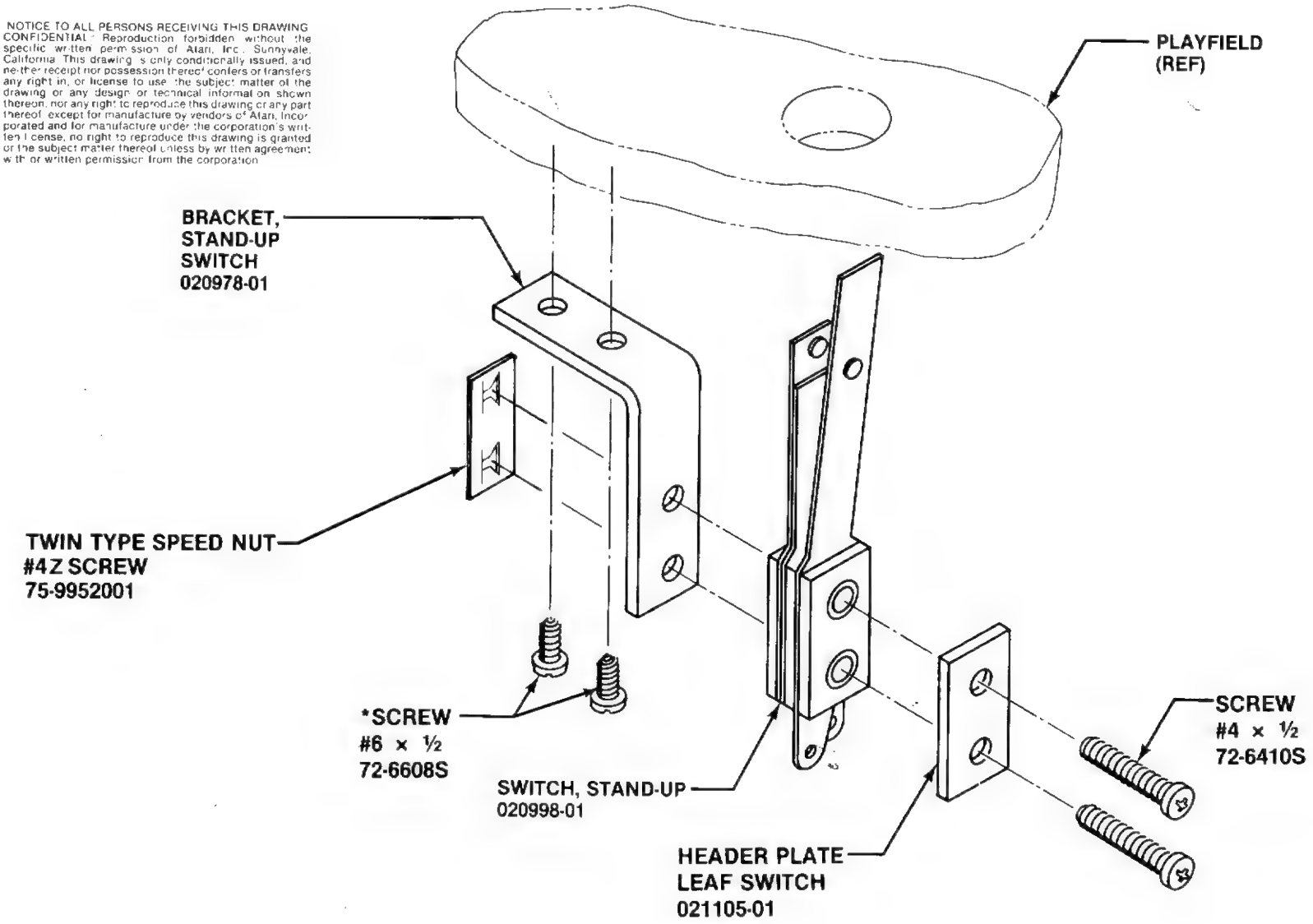
ATARI®



TARGET SWITCH
A020982-09

PLAYFIELD SUB-ASSEMBLY

ATARI®



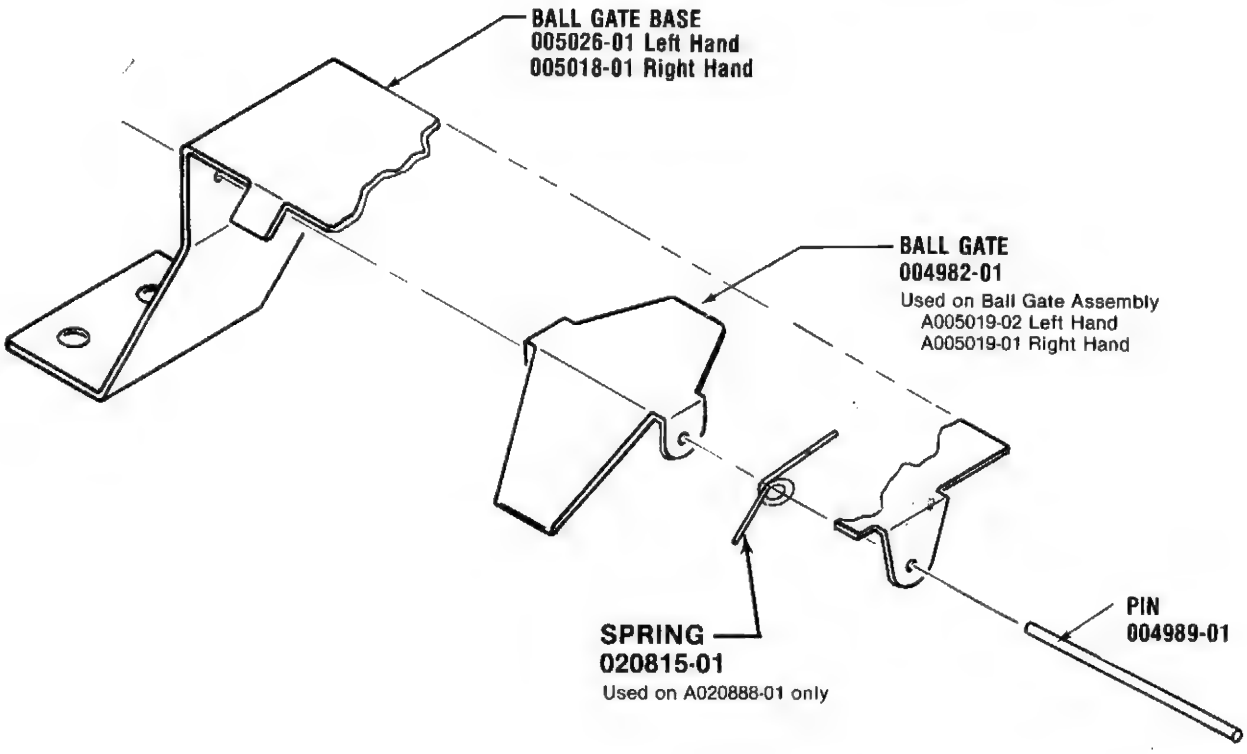
*PART OF PLAYFIELD ASSY

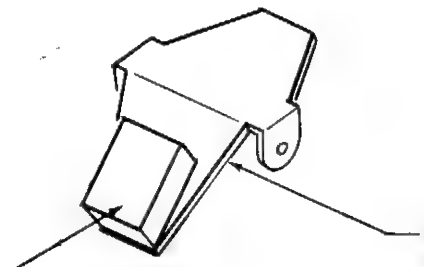
Section G
Sheet 65

SWITCH AND BRACKET
A021000-01

PLAYFIELD SUB-ASSEMBLY

ATARI®





NOTE:

RIGHT HAND GATE SHOWN.

ATARI®

PLAYFIELD SUB-ASSEMBLY

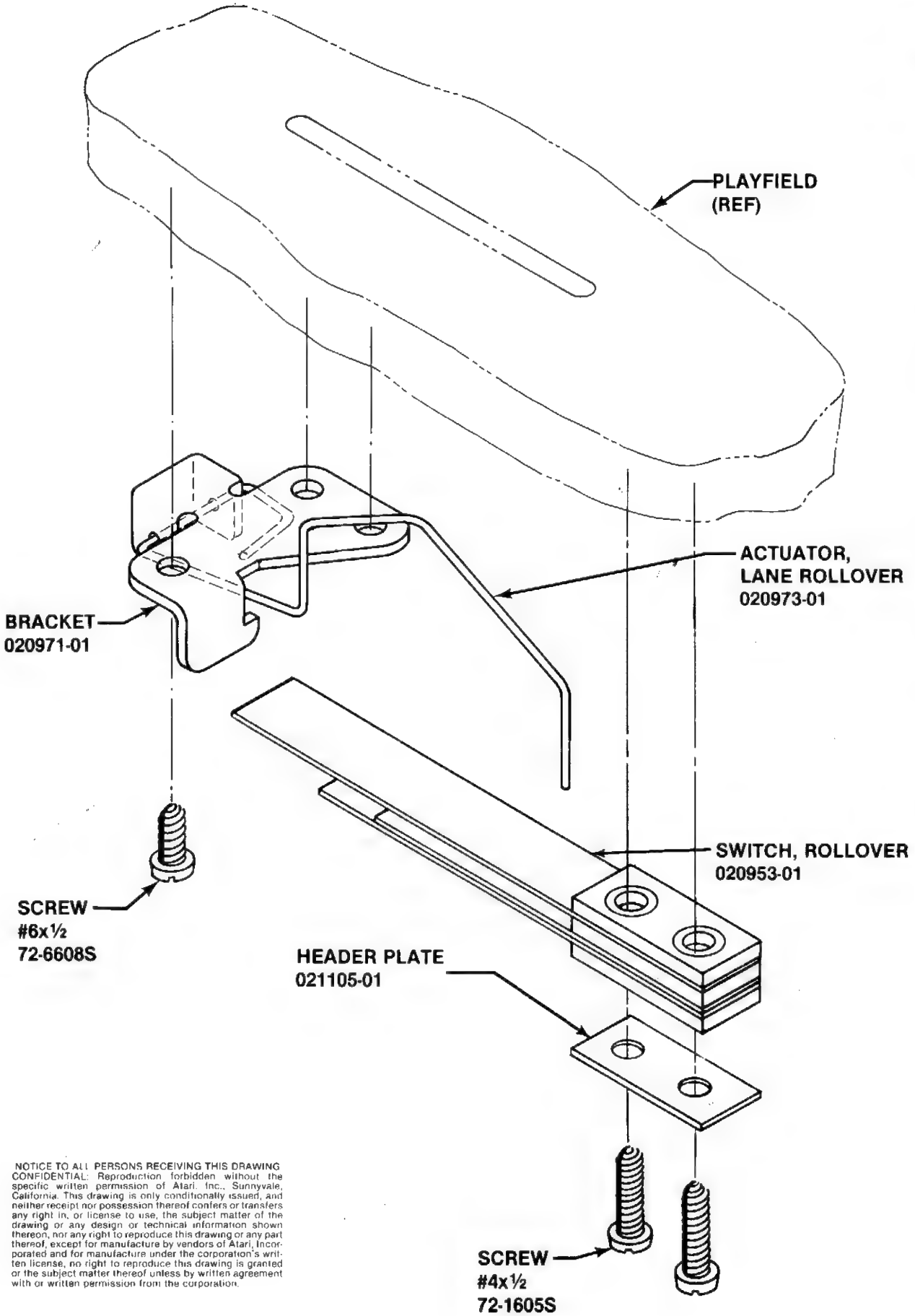
BALL GATE
A005019-01 thru -04
A020888-01

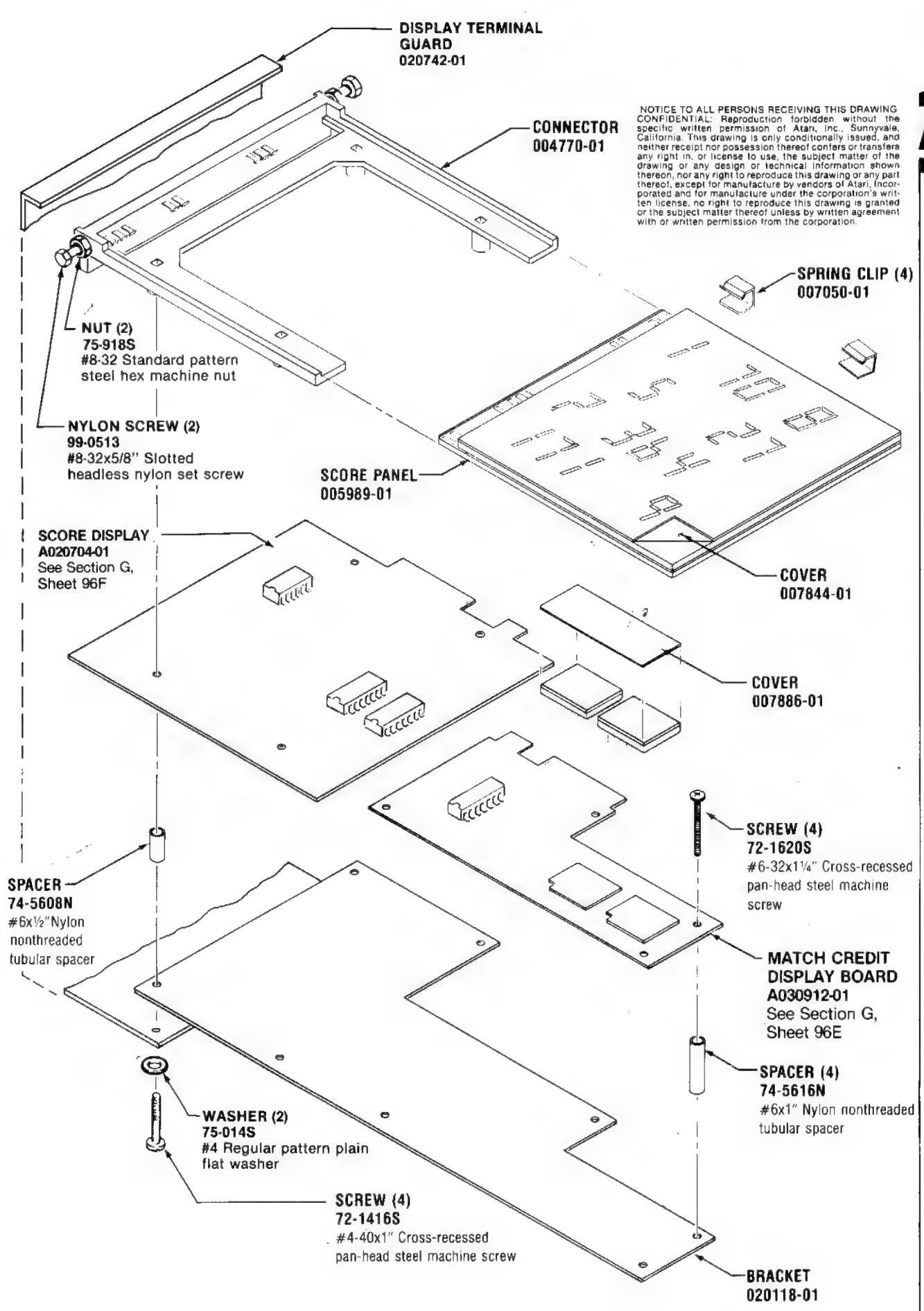
Section G
Sheet 76

ATARI®

PLAYFIELD SUB-ASSEMBLY

LANE ROLLOVER

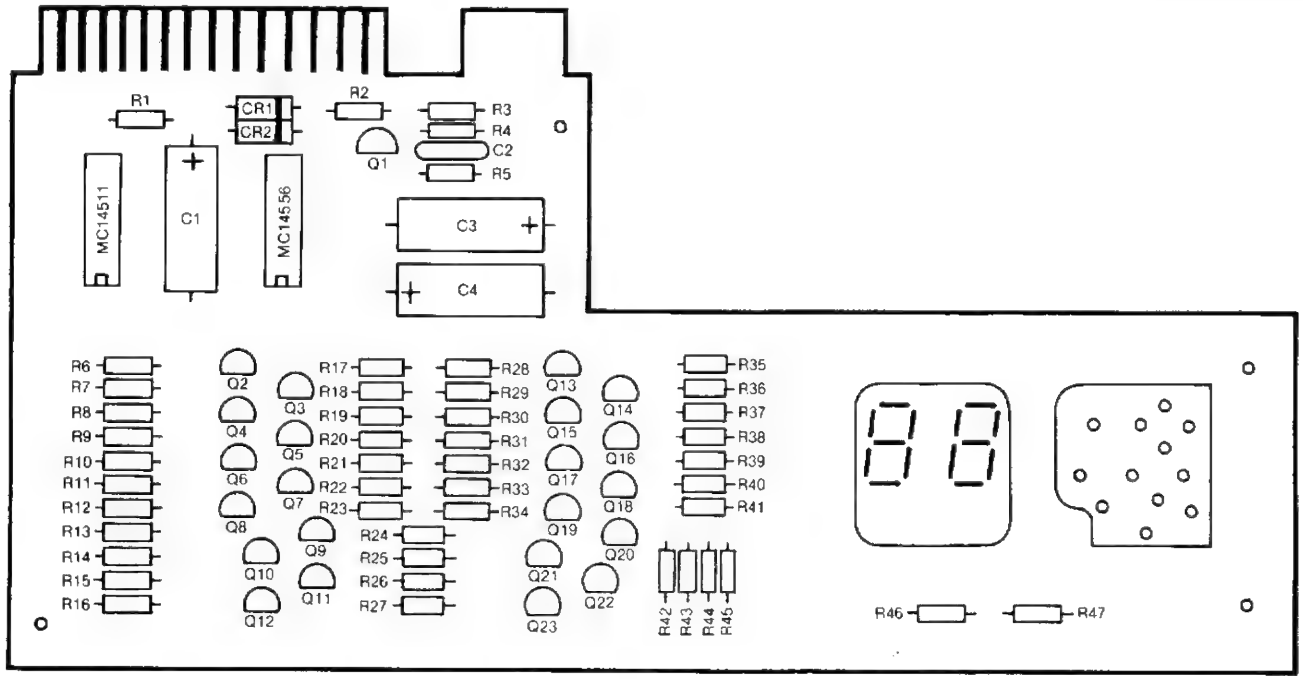




ATARI®

PLAYFIELD SUB-ASSEMBLY

SCORE DISPLAY
A020732-01



MATCH/CREDIT PCB
A030912-01

PLAYFIELD SUB-ASSEMBLY

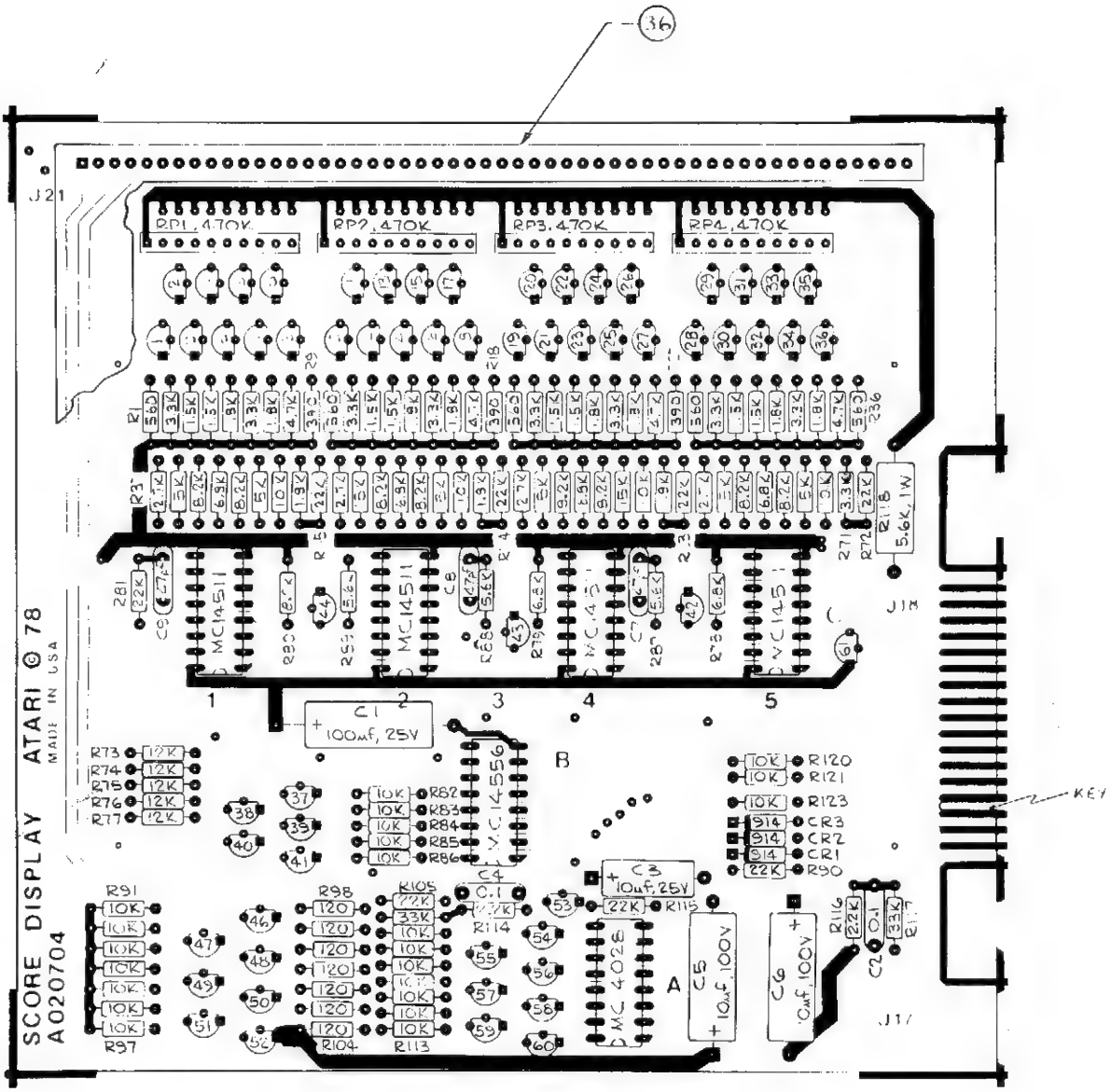
ATARI®

ATARI®

PLAYFIELD SUB-ASSEMBLY

MATCH/CREDIT PCB
A030912-01

DESIG-NATION	LOCA-TION	ITEM	PART NUMBER	DESCRIPTION
C1		11	24-250226	22 μf, +10%, -50%, 25 WVDC Axial Lead Electrolytic Capacitor
C2		13	29-005	0.1 μf Monolithic Ceramic Capacitor
C3,C4		12	25-101106	10 μf, +10%, -50%, 100 WVDC Axial Lead Electrolytic Capacitor
CR1,CR2		16	31-1N914	General Purpose Silicon Diode — Type 1N914
Q1		20	34-MPSA42	High Speed NPN General Purpose Amplifier — Motorola #MPSA42B
Q2-Q8		21	33-MPSA92	High Speed PNP General Purpose Amplifier — Motorola #MPSA92B
Q9-Q19		20	34-MPSA42	High Speed NPN General Purpose Amplifier — Motorola #MPSA42B
Q20-Q23		21	33-MPSA92	High Speed PNP General Purpose Amplifier — Motorola #MPSA92B
R1,R2		6	10-5104	100k ohm, ±5%, ¼W Carbon Composition Resistor
R3		5	10-5473	47k ohm, ±5%, ¼W Carbon Composition Resistor
R4		3	10-5332	3.3k ohm, ±5%, ¼W Carbon Composition Resistor
R5		5	10-5473	47k ohm, ±5%, ¼W Carbon Composition Resistor
R6-R27		4	10-5103	10k ohm, ±5%, ¼W Carbon Composition Resistor
R28-R34		2	10-5272	2.7k ohm, ±5%, ¼W Carbon Composition Resistor
R35-R41		7	10-5105	1M ohm, ±5%, ¼W Carbon Composition Resistor
R42-R45		6	10-5104	100k ohm, ±5%, ¼W Carbon Composition Resistor
R46,R47		8	10-5155	1.5M ohm, ±5%, ¼W Carbon Composition Resistor
		28	94-14SP-352	Two-Digit Gas-Discharge Display - BECKMAN #SP-352. Used for displaying MATCH and CREDIT numbers.
		27	79-41001	Two-Digit Display Socket - BECKMAN #CS-352



ATARI®

PLAYFIELD SUB-ASSEMBLY

SCORE DISPLAY DRIVE
A020704-01

Section G
Sheet 96F

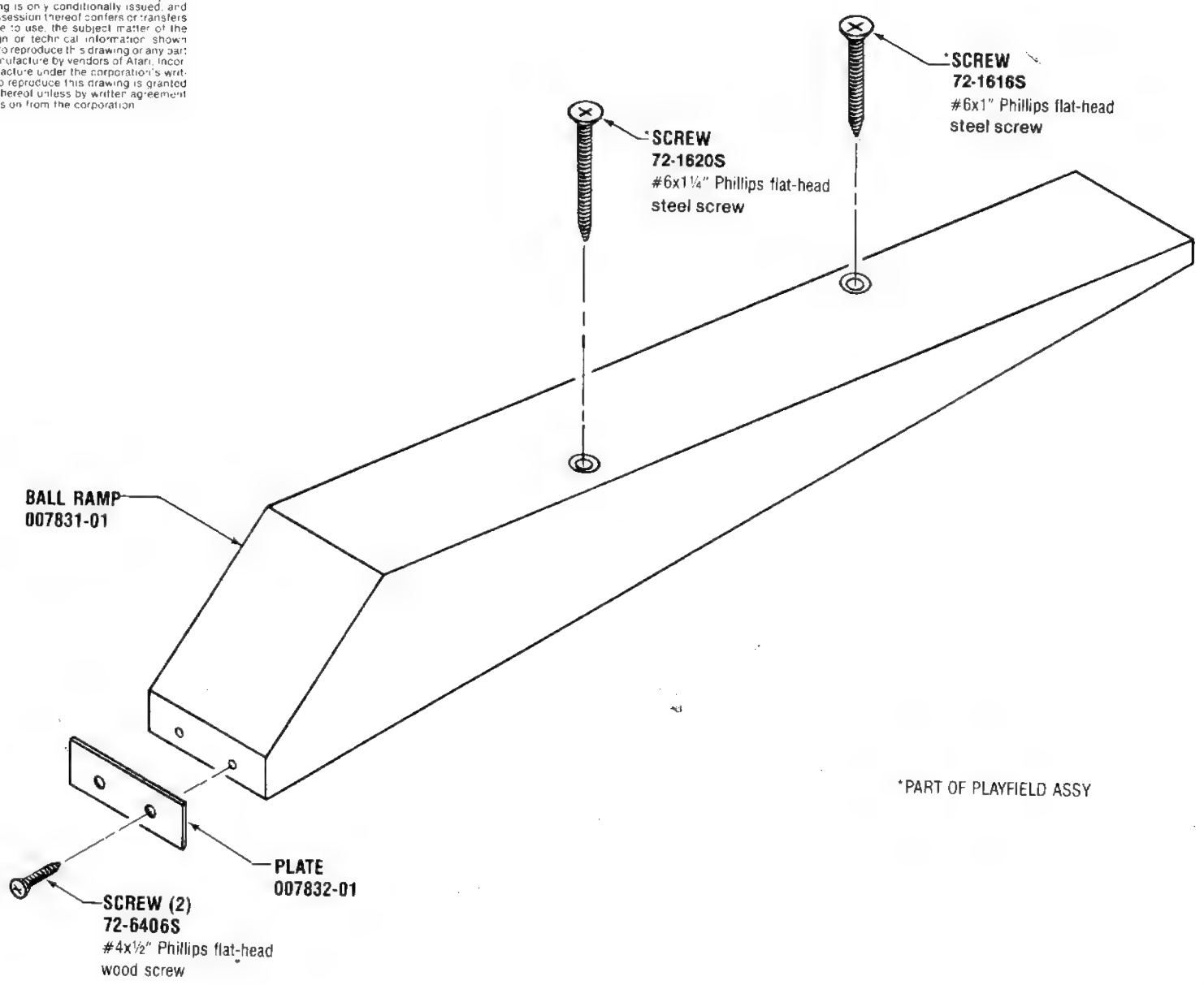
ATARI®

PLAYFIELD SUB-ASSEMBLY

SCORE DISPLAY DRIVE
A020704-01

DESIGNATION	LOCATION	ITEM	PART NUMBER	DESCRIPTION
C1		23	24-250170	100µf, +50, −10%, 25V Axial Lead Fixed Electrolytic Capacitor
C2		24	27-250104	0.1µf, plus/minus 20%, 25V Disc Ceramic Capacitor
C3		21	24-250106	10µf, +50, −10%, 25V Axial Lead Fixed Electrolytic Capactior
C4		24	27-250104	0.1µf, plus/minus 20%, 25V Disc Ceramic Capacitor
C5, C6		22	24-101106	10µf, +50, −10%, 100V Axial Lead Fixed Electrolytic Capacitor
C7-C9		25	28-101470	47pf, plus/minus 5%, 100V Radial Lead Dipped Mica Capacitor
CR1-CR3		27	31-1N914	General Purpose Silicon Signal Diode—Type 1N914
Q1-Q36		29	34-MPSA42	High Speed NPN General Purpose Amplifier—Motorola 3MPSA42
Q37-Q52		30	33-MPSA92	High Speed PNP General Purpose Amplifier—Motorola #MPSA92
Q53-Q61		29	34-MPSA42	High Speed NPN General Purpose Amplifiler—Motorola #MPSA42
R1		4	10-5561	560 ohm, plus/minus 5%, ¼W Carbon Composition Resistor
R2		9	10-5332	3.3K ohm, plus/minus 5%, ¼W Carbon Composition Resistor
R3		5	10-5152	1.5K ohm, plus/minus 5%, ¼W Carbon Composition Resistor
R4		5	10-5152	1.5K ohm, plus/minus 5%, ¼W Carbon Composition Resistor
R5		6	10-5182	1.8K ohm, plus/minus 5%, ¼W Carbon Composition Resistor
R6		9	10-5332	3.3K ohm, plus/minus 5%, ¼W Carbon Composition Resistor
R7		6	10-5182	1.8K ohm, plus/minus 5%, ¼W Carbon Comp-osition Resistor
R8		10	10-5472	4.7K ohm, plus/minus 5%, ¼W Carbon Composition Resistor
R9		3	10-5391	390 ohm, plus/minus 5%, ¼W Carbon Composition Resistor
R10		4	10-5561	560 ohm, plus/minus 5%, ¼W Carbon Composition Resistor
R11		9	10-5332	3.3K ohm, plus/minus 5%, ¼W Carbon Composition Resistor
R12, R13		5	10-5152	1.5K ohm, plus/minus 5%, ¼W Carbon Composition Resistor
R14		6	10-5182	1.8K ohm, plus/minus 5%, ¼W Carbon Composition Resistor
R15		9	10-5332	3.3K ohm, plus/minus 5%, ¼W Carbon Composition Resistor
R16		6	10-5182	1.8K ohm, plus/minus 5%, ¼W Carbon Composition Resistor
R17		10	10-5472	4.7K ohm, plus/minus 5%, ¼W Carbon Composition Resistor
R18		3	10-5391	390 ohm, plus/minus 5%, ¼W Carbon Composition Resistor
R19		4	10-5561	560 ohm, plus/minus 5%, ¼W Carbon Composition Resistor
R20		9	10-5332	3.3K ohm, plus/minus 5%, ¼W Carbon Composition Resistor
R21, R22		5	10-5152	1.5K ohm, plus/minus 5%, ¼W Carbon Composition Resistor
R23		6	10-5182	1.8K ohm, plus/minus 5%, ¼W Carbon Composition Resistor
R24		9	10-5332	3.3K ohm, plus/minus 5%, ¼W Carbon Composition Resistor
R25		6	10-5182	1.8K ohm, plus/minus 5%, ¼W Carbon Composition Resistor
R26		10	10-5472	4.7K ohm, plus/minus 5%, ¼W Carbon Composition Resistor
R27		3	10-5391	390 ohm, plus/minus 5%, ¼W Carbon Composition Resistor
R28		4	10-5561	560 ohm, plus/minus 5%, ¼W Carbon Composition-Resistor
R29		9	10-5332	3.3K ohm, plus/minus 5%, ¼W Carbon Composition Resistor
R30, R31		5	10-5152	1.5K ohm, plus/minus 5%, ¼W Carbon Composition Resistor
R32		6	10-5182	1.8K ohm, plus/minus 5%, ¼W Carbon Composition Resistor
R33		9	10-5332	3.3K ohm, plus/minus 5%, ¼W Carbon Composition Resistor
R34		6	10-5182	1.8K ohm, plus/minus 5%, ¼W Carbon Composition Resistor
R35		10	10-5472	4.7K ohm, plus/minus 5%, ¼W Carbon Composition Resistor
R36		4	10-5561	560 ohm, plus/minus 5%, ¼W Carbon Composition Resistor
R37		8	10-5272	2.7K ohm, plus/minus 5%, ¼W Carbon Composition Resistor
R38		15	10-5153	15K ohm, plus/minus 5%, ¼W Carbon Composition Resistor
R39		12	10-5822	8.2K ohm, plus/minus 5%, ¼W Carbon Composition Resistor
R40		11	10-5682	6.8K ohm, plus/minus 5%, ¼W Carbon Composition Resistor
R41		12	10-5822	8.2K ohm, plus/minus 5%, ¼W Carbon Composition Resistor
R42		15	10-5153	15K ohm, plus/minus 5%, ¼W Carbon Composition Resistor
R43		13	10-5103	10K ohm, plus/minus 5%, ¼W Carbon Composition Resistor
R44		6	10-5182	1.8K ohm, plus/minus 5%, ¼W Carbon Composition Resistor
R45		16	10-5223	22K ohm, plus/minus 5%, ¼W Carbon Composition Resistor
R46		8	10-5272	2.7K ohm, plus/minus 5%, ¼W Carbon Composition Resistor
R47		15	10-5153	15K ohm, plus/minus 5%, ¼W Carbon Composition Resistor
R48		12	10-5822	8.2K ohm, plus/minus 5%, ¼W Carbon Composition Resistor
R49		11	10-5682	6.8K ohm, plus/minus 5%, ¼W Carbon Composition Resistor
R50		12	10-5822	8.2K ohm, plus/minus 5%, ¼W Carbon Composition Resistor
R51		15	10-5153	15K ohm, plus/minus 5%, ¼W Carbon Composition Resistor
R52		13	10-5103	10K ohm, plus/minus 5%, ¼W Carbon Composition Resistor
R53		6	10-5182	1.8K ohm, plus/minus 5%, ¼W Carbon Composition Resistor
R54		16	10-5223	22K ohm, plus/minus 5%, ¼W Carbon Composition Resistor
R55		8	10-5272	2.7K ohm, plus/minus 5%, ¼W Carbon Composition Resistor
R56		15	10-5153	15K ohm, plus/minus 5%, ¼W Carbon Composition Resistor
R57		12	10-5822	8.2K ohm, plus/minus 5%, ¼W Carbon Composition Resistor
R58		11	10-5682	6.8K ohm, plus/minus 5%, ¼W Carbon Composition Resistor

DESIGNATION	LOCATION	ITEM	PART NUMBER	DESCRIPTION
R59		12	10-5822	8.2K ohm, plus/minus 5%, ¼W Carbon Composition Resistor
R60		15	10-5153	15K ohm, plus/minus 5%, ¼W Carbon Composition Resistor
R61		13	10-5103	10K ohm, plus/minus 5%, ¼W Carbon Composition Resistor
R62		6	10-5182	1.8K ohm, plus/minus 5%, ¼W Carbon Composition Resistor
R63		16	10-5223	22K ohm, plus/minus 5%, ¼W Carbon Composition Resistor
R64		8	10-5272	2.7K ohm, plus/minus 5%, ¼W Carbon Composition Resistor
R65		15	10-5153	15K ohm, plus/minus 5%, ¼W Carbon Composition Resistor
R66		12	10-5822	8.2K ohm, plus/minus 5%, ¼W Carbon Composition Resistor
R67		11	10-5682	6.8K ohm, plus/minus 5%, ¼W Carbon Composition Resistor
R68		12	10-5822	8.2K ohm, plus/minus 5%, ¼W Carbon Composition Resistor
R69		15	10-5153	15K ohm, plus/minus 5%, ¼W Carbon Composition Resistor
R70		13	10-5103	10K ohm, plus/minus 5%, ¼W Carbon Composition Resistor
R71		9	10-5332	3.3K ohm, plus/minus 5%, ¼W Carbon Composition Resistor
R72		16	10-5223	22K ohm, plus/minus 5%, ¼W Carbon Composition Resistor
R72-R77		14	10-5123	12K ohm, plus/minus 5%, ¼W Carbon Composition Resistor
R78, R79		11	10-5682	6.8K ohm, plus/minus 5%, ¼W Carbon Composition Resistor
R80		12	10-5822	8.2K ohm, plus/minus 5%, ¼W Carbon Composition Resistor
R81		16	10-5223	22K ohm, plus/minus 5%, ¼W Carbon Composition Resistor
R82-R86		13	10-5103	10K ohm, plus/minus 5%, ¼W Carbon Composition Resistor
R87-R89		20	10-5562	5.6K ohm, plus/minus 5%, ¼W Carbon Composition Resistor
R90		16	10-5223	22K ohm, plus/minus 5%, ¼W Carbon Composition Resistor
R91-R97		13	10-5103	10K ohm, plus/minus 5%, ¼W Carbon Composition Resistor
R98-R104		2	10-5121	120 ohm, plus/minus 5%, ¼W Carbon Composition Resistor
R105		16	10-5223	22K ohm, plus/minus 5%, ¼W Carbon Composition Resistor
R106		17	10-5333	33K ohm, plus/minus 5%, ¼W Carbon Composition Resistor
R107-R113		13	10-5103	10K ohm, plus/minus 5%, ¼W Carbon Composition Resistor
R114		7	10-5222	2.2K ohm, plus/minus 5%, ¼W Carbon Composition Resistor
R115		16	10-5223	22K ohm, plus/minus 5%, ¼W Carbon Composition Resistor
R116		7	10-5222	2.2K ohm, plus/minus 5%, ¼W Carbon Composition Resistor
R117		17	10-5333	33K ohm, plus/minus 5%, ¼W Carbon Composition Resistor
R118		18	12-5562	5.6K ohm, plus/minus 5%, ¼W Carbon Composition Resistor
R120, R121		13	10-5103	10K ohm, plus/minus 5%, ¼W Carbon Composition Resistor
RP1-RP4		19	19-012	Single In-Line Package, 470K ohm, plus/minus 2%, ¼W
	A4	32	37-14028	BCD-to-Decimal/Binary-to-Octal Decoder-Type MC14028
	C1, C2, C4, C5	33	37-14511	BCD-to-Seven Segment Latch/Decoder/Driver—Type MC14511
	B3	34	37-14556	Dual Binary-to-1-of-4 Decoder/Demultiplexer (Inverting)—Type MC14556
		36	004770-01	Score Panel Connector—Teledyne Kenetics PN S411U052



*PART OF PLAYFIELD ASSY

Ball Return Ramp
A007833-01

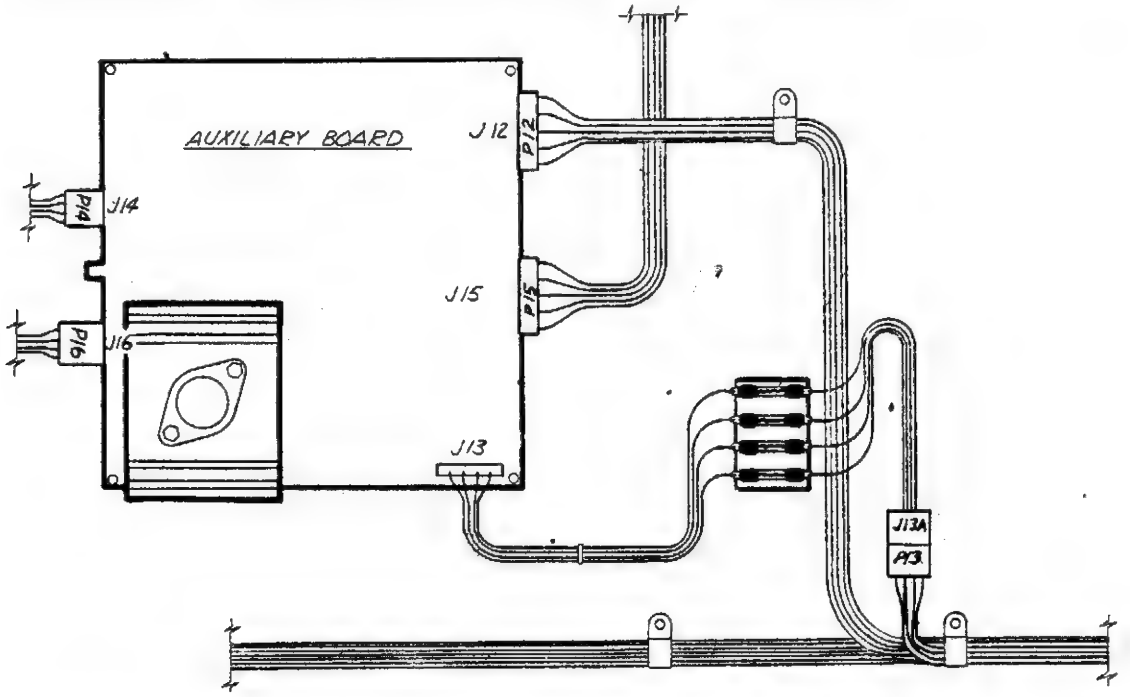
PLAYFIELD SUB-ASSEMBLY

ATARI®

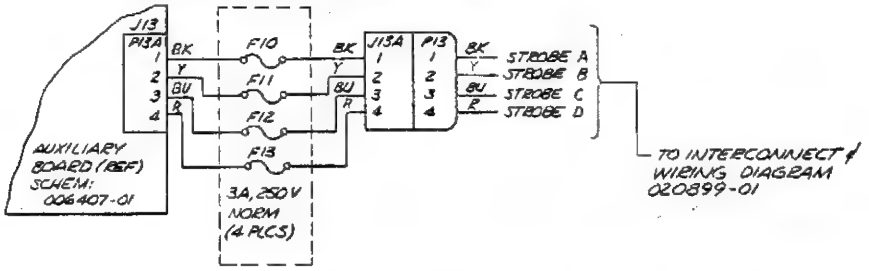
ATARI®

LAMP STROBE FUSE BLOCK

On the inside left Cabinet wall, we have added a Fuse Block between connector J13 of the Auxiliary PCB and harness plug P13, as shown below:



The Fuse Block contains four 3amp @ 250V, Normal-Blow, type 3AG fuses, labeled F10 thru F13, that protect the Auxiliary PCB lamp driver transistors Q6 thru Q9. Schematically, this change is as shown below:



We suggest you mark this change in your Space Riders Operation, Maintenance and Service Manual, Atari Publication No. TM-119. This change affects the following pages:

Pages 3-4, 5-8, 5-13, 6-2, and 6-3

ATARI INC 1265 BORREGAS AVENUE. P.O. BOX 9027. SUNNYVALE. CALIFORNIA 94086 • TELEPHONE (408) 745-2000 • TELEX 35-7488

A Warner Communications Company

TM-119
1st printing

YOUR COMMENTS, PLEASE!

Your comments will assist Atari in improving the usefulness of our publications. They are an important part of preparing for revisions of manuals and parts catalogs. No postage stamp is necessary if mailed in the U.S.A.

If you have any technical questions about certain Atari or Kee Games products, or are requesting additional publications, we will immediately forward your note to the appropriate person.

Page: **Comments:**

Cut along this line

Fill in if you wish a reply:

Name _____ Firm _____ ☐ Distributor
☐ Operator
Address _____ ☐ Other _____

City _____ State _____ Zip _____

First Fold

First Class
Permit #1004
Sunnyvale, CA

BUSINESS REPLY MAIL
No postage stamp necessary if mailed in the U.S.A.

Atari, Inc.
P.O. Box 9027
Sunnyvale, California 94086

Attn.: Publications Group, Coin-Op Engineering

Cut along this line

Second Fold

Atari, Inc.
P.O. Box 9027
Sunnyvale, CA 94086

WARRANTY

Seller warrants that its printed circuit boards and parts thereon are free from defects in material and workmanship under normal use and service for a period of ninety (90) days from date of shipment. Seller warrants that its television monitors (in games supplied with monitors) are free from defects in material and workmanship under normal use and service for a period of thirty (30) days from date of shipment. None of the Seller's other products or parts thereof are warranted.

If the products described in this manual fail to conform to this warranty, Sellers' sole liability shall be, at its option, to repair, replace, or credit Buyer's account for such products which are returned to Seller during said warranty period, provided:

(a) Seller is promptly notified in writing upon discovery by Buyer that said products are defective;

(b) Such products are returned prepaid to Sellers' plant; and

(c) Seller's examination of said products discloses to Seller's satisfaction that such alleged defects existed and were not caused by accident, misuse, neglect, alteration, improper repair, installation or improper testing.

In no event shall Seller be liable for loss of profits, loss of use, incidental or consequential damages.

EXCEPT FOR ANY EXPRESS WARRANTY SET FORTH IN A WRITTEN CONTRACT BETWEEN SELLER AND BUYER WHICH CONTRACT SUPERSEDES THE TERMS OF THIS ORDER, THIS WARRANTY IS EXPRESSED IN LIEU OF ALL OTHER WARRANTIES EXPRESSED OR IMPLIED, INCLUDING THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, AND OF ALL OTHER OBLIGATIONS OR LIABILITIES ON THE SELLER'S PART, AND IT NEITHER ASSUMES NOR AUTHORIZES ANY OTHER PERSON TO ASSUME FOR THE SELLER ANY OTHER LIABILITIES IN CONNECTION WITH THE SALE OF PRODUCTS UNDER THIS ORDER.

ATARI INC
1265 BORREGAS AVENUE
P.O. BOX 9027
SUNNYVALE, CALIFORNIA 94086
408/745-2000 • TELEX 35-7488